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EPA (Environmental Protection Agency) Research Program Guide, FY-1987 October 1, 1986-September 30, 1987

(U.S.) Environmental Protection Agency
Washington, DC

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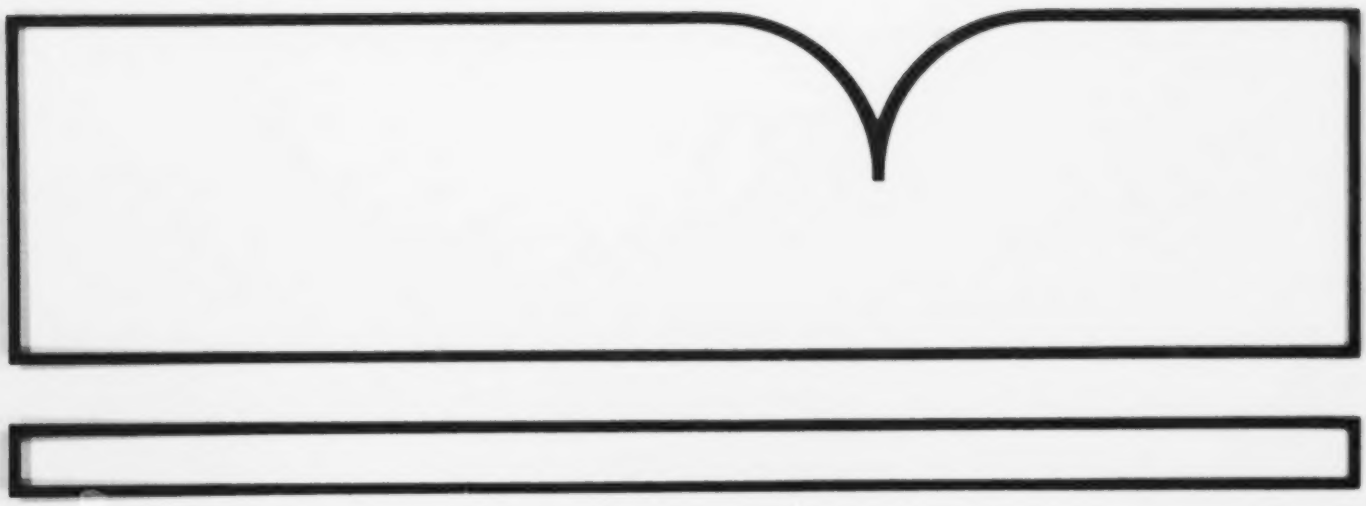

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The free and open exchange of knowledge both stimulates and provides quality control for the progress of science. This report provides information on the research which EPA is planning for this fiscal year, on how much we intend to spend on each program area, and on whom to contact for further details. More than 60 percent of our research budget will be spent through extramural contracts, grants, and cooperative agreements with organizations outside of EPA's laboratories.

It is our intent to increase the efficiency and effectiveness of this research by placing great emphasis upon open competition for extramural support. We hope that the information in this report will stimulate qualified parties and make their capabilities known to our research managers so that we all might gain from sharing experience and expertise.

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FY-1987 EPA Research Program Guide

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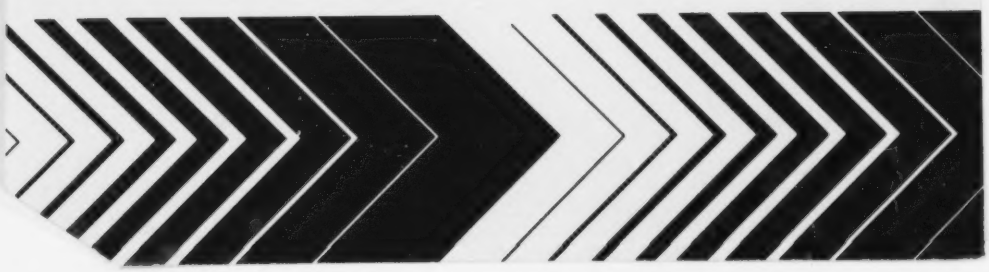

Notice

The program descriptions and resource estimates included in this document reflect the latest detailed information available at time of publication. Time and pending Congressional actions will change some of this information. In addition, the resource figures have been rounded off and some smaller programs omitted. For the latest information, you may want to contact the individual listed.

EPA/600/9-86/028
September 1986

FY-1987 EPA Research Program Guide

October 1, 1986 — September 30, 1987

Office of Research and Development
U.S. Environmental Protection Agency
Washington, DC 20460

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Introduction

The free and open exchange of knowledge both stimulates and provides quality control for the progress of science. This report provides information on the research which EPA is planning for this fiscal year, on how much we intend to spend on each program area, and on whom to contact for further details. More than 60 percent of our research budget will be spent through extramural contracts, grants, and cooperative agreements with organizations outside of EPA's laboratories.

It is our intent to increase the efficiency and effectiveness of this research by placing great emphasis upon open competition for extramural support. We hope that the information in this report will stimulate qualified parties and make their capabilities known to our research managers so that we all might gain from sharing experience and expertise. Please feel free to contact any of the parties listed in this report.

How to Use the Program Guide

The following descriptions of ORD's research program are organized first by media such as air, water, hazardous wastes, etc. These categories are further broken down into research foci such as scientific assessment, monitoring and quality assurance, health effects, environmental processes, and engineering technology. Each description is a very broad summary of the research being done, where that research is being done, who to contact for more information about the program, and both the approximate total funding for that area and the percentage of total funding which is reserved by EPA for in-house research. Funding which is not reserved for in-house research is spent through extramural contracts, grants and cooperative agreements.

For each program description, one or more contacts are listed along with the major research areas to be pursued. For further information, you may call the contacts. Their commercial and Federal (FTS) telephone numbers are listed in a separate section near the end of this report. Where two or more research laboratories are listed, please turn to the "EPA R&D Organization" section of this report for descriptions of the major mission and functions of each.

Some of the research funded for this fiscal year will be done in-house by EPA's laboratories. The rest will be accomplished extramurally. Proposals for funds for research in areas of interest to the agency are welcomed and are considered on a competitive basis. To receive information regarding application procedures for extramural funds, please contact the person indicated in the area of specific interest to you. In addition, approximately fifteen percent of EPA's research budget is used to support long-term exploratory research. Information regarding funds for exploratory research grants can be obtained from the:

Research Grants Program
Office of Exploratory Research (RD-675)
USEPA
Washington, DC 20460
(202) 382-5750

Finally, for further information regarding Office of Research and Development research publications (600/series) or for additional copies of this report, please contact:

Center for Environmental Research Information
USEPA
26 W. St. Clair
Cincinnati, OH 45268
CML (513) 569-7562
FTS 8-684-7562

Air

Global and Microenvironmental

Acid Deposition Environmental Monitoring and Quality Assurance

Indoor air research consists of development and testing of monitoring devices and the design and implementation of field studies to identify and quantitate pollutants indoors. This research supports investigation of pollutant sources, exposures and health effects.

Methods development research investigates monitoring devices for pollution monitoring levels in homes. Results are used to produce information regarding proper use (sample locations and sample times) and performance limitations of these devices. This research will continue to develop and test these devices, especially personal monitors, in other microenvironments (buildings, vehicles, etc.).

Survey designs are emphasized in field studies. National multipollutant field studies designed for combustion and volatile organic compounds stimulated an interest to design a pilot study to investigate the distribution and use of consumer products. This field study will be designed and implemented in conjunction with an intensive review of data needs to better understand indoor air pollution. Based on these results, additional field studies will be conducted to increase our understanding about indoor air pollution.

Research into global climate change will develop tropospheric chemistry models to predict the impact of changes in trace gases, temperature, and humidity in the troposphere on tropospheric ozone and the hydroxyl radical.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/RTP	John Puzak	1,350.0	15
ADEMQA/HQ	Lance Wallace Mike Dellarco	50.0	0
ASRL/RTP	Basil Dimitriades	250.0	0

Global and Microenvironmental

Environmental Processes and Effects

This research provides state-of-the-art information on the causes, biological and health effects and control strategies for stratospheric ozone depletion. The work should reliably quantify effects of increasing intensity of ultra-violet B radiation which causes increased biological damage to agricultural productivity, marine and freshwater food chains for economically useful fish and to overall global climate. Field, laboratory and modeling efforts addressing the biological effects of UV-B and will concentrate on sensitive field crops, and on dose responses to marine and

fresh water food webs. The nature of UV-B damage to competitive specie interactions and critical energy flow through the ecosystems may be examined. Health effects studies will examine immunotoxicity and genotoxicity effects due to UV-B exposure. Influence of UV-B on ozone and its implications on ozone air quality attainment/non-attainment need preliminary examination. These data are sought to provide an authoritative scientific base for regulatory decisions on stratospheric ozone protection.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/COR	James McCarty	679.9	0.0
OEPER/HQ	Kenneth Hood	45.9	0.0
HERL/RTP	Judith Graham	45.0	0.0
AEERL/RTP	William Rhodes	170.0	29.0

Global and Microenvironmental

Health Effects

The goal of the indoor air health effects research program is to determine whether exposure to indoor air pollution contributes or leads to adverse health effects. Indoor air often contains higher levels of pollutants than outdoor air. Most individuals spend over 80% of their time indoors. Sensitive populations, e.g., children and the elderly, may be at higher risk from exposure to indoor air pollution. Therefore, the exposure, dose, and effects from indoor air pollution needs to be factored into the total picture of air pollution.

The approach to study the effects of indoor air is broad. Genetic bioassay studies of the combustion products from indoor air sources will be conducted in chambers, test homes, and targeted field studies to provide a comparative estimate of the potential cancer risk from various sources. Human clinical studies in chambers of volatile organic compounds will be conducted to determine effects related to the "sick building syndrome." Field and clinical studies will continue to evaluate cotinine as a biochemical marker for nicotine.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Richard Dickerson	500	20
OHR/HQ	Donna Kuroda		

Air

Hazardous Air Pollutant Regulatory Activities

Environmental Engineering and Technology

The engineering program for hazardous air pollutants (HAP) is comprised of four parts: (1) to assess various industrial and combustion sources of HAPs to determine the magnitude of emissions and to assess the capability of technologies to reduce or eliminate HAP emissions; (2) to conduct source-related measurements and participate in the management of the Agency's Integrated Air Cancer Project; (3) to assess the emissions from and controllability of sources of indoor air pollutants; and (4) to assess the emissions from and controllability of accidental releases of high hazard chemicals.

Conventional devices for controlling particulate and VOC emissions will be evaluated for their effectiveness in controlling specific HAPs from industrial and combustion sources. Research will be initiated on cleaner-burning wood stoves, with inherently low emissions of HAPs, for practical and energy-efficient residential use.

Field and laboratory measurements of hazardous substances, especially mutagenic substances from residential wood stoves will be made as part of the field studies of the Integrated Air Cancer Project. Various designs of catalyst-equipped and conventional stoves will be tested.

Laboratory measurements of organic pollutants emissions from unvented space heaters, building materials, and consumer products will be continued from indoor air quality projects initiated earlier. A computerized database will be developed on indoor source emissions. Test house studies of indoor sources will be started. Further work to develop indoor air quality models is also planned. Engineering evaluations will be undertaken of air cleaners for indoor particles and for indoor organics vapors.

The issue of accidental releases will be addressed through a study of hazard identification and evaluation techniques, preparation of reference manuals for key hazard chemicals, and technical support to regions and states to assist in preventing such releases or reducing the hazards once such a release has occurred.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	W. Gene Tucker	3,562.6	47
OEET/HQ	Paul Shapiro	0	0
	Marshall Dick		

Hazardous Air Pollutant Regulatory Activities

Health Effects

The health research program in hazardous air pollutants (HAPs) has three goals: to develop and validate techniques

to evaluate the toxic effects of HAPs, to produce dose-response data on the toxic effects of HAPs, and to develop methods which improve our ability to use toxicological data in performing risk assessments. Extramural research will support efforts in all three areas.

EPA researchers will develop methods to provide data on the genetic, developmental, and neurotoxic effects of HAPs. Emphasis of this research will be on the toxic components of gaseous-aerosol complex mixtures and source emissions.

In dose-response toxicological research data on the mutagenic and carcinogenic activity and noncancerous health effects of potential HAPs will be determined. These HAPs will be selected based upon assessments prepared by the Office of Health and Assessment (OHEA) and research needs identified by Office of Air Quality, Planning, and Standards (OAQPS). The effects of selected chemicals suspected of being hazardous to the nervous system will be studied.

The *dose-exposure* research will provide quantitative information on the relationship between dose (body burden) and human exposures to toxic pollutants. Models of neurologic toxicity will be developed involving physical, chemical, and behavioral tests to predict human responses to insult from potential HAPs.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL RTP	Richard Dickerson	5,375.2	59
OHR HQ	Donna Kuroda		

Hazardous Air Pollutant Regulatory Activities

Acid Deposition Environmental Monitoring and Quality Assurance

At present, there is a particular need for technology to monitor non-criteria contaminants at the regional, state, and local level. EPA has developed monitoring stations for non-criteria pollutants in Boston, Chicago, and Houston. The stations will function as focal points for development and evaluation of monitoring methods in ambient air. Stationary source methods will be evaluated and validated. Methods for asbestos, cadmium, nickel, dioxins, and gaseous organics are needed. In addition, certain advanced methods will be evaluated, including cryogenic preconcentrations and gas chromatography/Fourier transform infrared (FTIR) spectrometry.

To support quality assurance needs within the program, reference samples will be developed and maintained,

guidelines for procedures will be developed, and laboratory audits will be performed.

A series of studies to monitor human exposure are being carried out, including the Integrated Air Cancer Project (IACP) and the Total Human Exposure Assessment Methodology (TEAM) studies.

In the Characterization, Transport, and Fate research program, laboratory and field studies will be conducted to determine the atmospheric lifetimes and transformation products of HAPs to determine deposition and removal rates of hazardous chemicals; and identify the factors responsible for concentration levels and spatial and temporal (i.e., seasonal) variability of selected volatile organic compounds. Also, research studies will examine the atmospheric chemical and physical processes that are important in producing mutagenic compounds in the atmosphere. The information obtained from this program is used for preparing health assessment documents to determine if chemicals in the atmosphere present a hazard.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/RTP	John Clements Steve Bromberg	8,820.8	35
ASRL/RTP (CTF)	Larry Cupitt	1,479.4	26
ADEMQA/HQ (CTF)	Deran Pashayan	25.4	0
ADEMQA/HQ	Lance Wallace	814.0	37

Hazardous Air Pollutant Regulatory Activities

Scientific Assessment

Scientific assessments of HAPs evaluate pertinent research findings concerning the health effects of particular substances emitted from restricted stationary sources and/or their transformation products, as well as background information on physical and chemical properties, sources, emissions, transport and transformation, and ambient concentrations. Such assessments also evaluate chemical compositions of fuel additives, diesel and gasoline exhausts, information on actual human exposure to motor vehicle pollutants, and evidence of resulting health effects.

The Agency strategy for assessing the toxicity of various chemical substances nominated by the Office of Air Quality Planning and Standards consists of the following steps. The first is the preparation of a summary health issue

assessment. This is an initial review of the scientific literature concerning the most important health effects associated with a given chemical or class of chemical substances. If the evidence suggests there are significant health effects associated with exposure to the substance(s) reviewed, then a draft health assessment document is developed for scientific review at a public workshop. If the scientific peer review supports the conclusion that there are significant health effects, then a comprehensive health assessment is developed for public comment and Science Advisory Board review prior to final publication.

In addition, during FY 87, the Scientific Assessment Program will also provide direct assessment support to Regions and States for Agency Air Toxics Strategy.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/RTP	Lester Grant	3,560	54

Mobile Source Pollutant Regulatory Activities

Health Effects

The health effects program developed by the Health Effects Research Laboratory in mobile sources develops and validates techniques to produce dose-response data on the toxic effects of carbon monoxide, and then use those techniques to produce dose-response information.

Clinical studies will be used to produce dose-response data on the toxic effects of low-level exposure to CO. The cardiac and respiratory effects of CO will be evaluated in human studies, as well as methods to related ambient CO levels to blood levels. Non-invasive techniques will be used to measure the cardiac effects of CO exposure. In addition, neurobehavioral effects of CO exposure will be evaluated. This information will be used in performing health risk assessments by the scientific assessment program.

Extramural funding will also be provided to the Health Effects Institute, sponsored jointly by EPA and the automobile industry to perform research on the health effects of pollutants related to mobile sources, i.e., diesel emissions, NO_2, CO, O_3, and aldehydes.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Richard Dickerson	Funding not available at this time.	
OHR/HQ	Donna Kuroda		

Air

Mobile Source Pollutant Regulatory Activities

Acid Deposition Environmental Monitoring and Quality Assurance

The purpose of the Characterization, Transport, and Fate portion of this program is to characterize the emissions from motor vehicles using both traditional fuels as well as alternative fuels, such as methanol.

Laboratory studies of the impact of low ambient temperature on the emission rates of criteria and non-criteria pollutants from light duty motor vehicles will continue. Emphasis will be directed to the composition of organic emissions. Studies of the relationship between fuel composition, including gasoline and gasoline-alcohol blends, and the composition and rate of tailpipe, evaporative, and refueling emissions will continue. Other programs will emphasize the development of analytical procedures suitable for real-time measurement of motor vehicle emissions. Procedures for determination of the operating condition of motor vehicle emission control devices will be evaluated. Programs for examination, development, and improvement of procedures for apportionment of observed ambient pollution to motor vehicles will begin.

Studies will also be conducted to characterize organic emissions from motor vehicles under widely variant operating conditions, i.e., temperature, speed, and fuels. Emission rates of formaldehyde, benzene, branched paraffins, and other organic compounds of interest will be determined.

Research in the Monitoring Systems and Quality Assurance portion of the program focuses on developing methodology for determining exposures of the population to mobile source pollutants. A general methodology has been developed for measuring and modeling the exposures of the population to carbon monoxide, and this methodology has been successfully field tested. Future research will extend this methodology to other locations and, where possible, to other mobile source air pollutants. Detailed analyses of human exposure field data collected in selected highway microenvironments will be undertaken to develop improved commuter exposure models incorporating traffic variables (roadway type, traffic count, trip time, and seasonal characteristics). Data on human activity patterns and time budgets will be further evaluated. Improved models of human activity patterns and microenvironmental concentrations will be developed and field tested. The Simulation of Human Activities and Pollutant Exposure (SHAPE) methodology will be modified and validated using field data from another urban area. Additional testing of basic assumptions in NAAQS

Exposure Model (NEM) will be undertaken. The purpose will be to improve the accuracy and reliability of the Agency's exposure assessment methodology for mobile source pollutants.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/RTP	Gerald Akland	493.6	53
ADEMQA/HQ	Wayne Ott	--	--
ASRL/RTP (CTF)	Frank Black	1,287.4	60
ADEMQA/HQ (CTF)	William Keith	6.9	0

National Ambient Air Quality Standards (NAAQS)

Acid Deposition Environmental Monitoring and Quality Assurance

The Characterization, Transport, and Fate portion of this program is responsible for conducting studies to determine the air pollution and meteorological factors that contribute to visibility reduction, and for developing information on the effects of particles on materials. Light extinction budget field studies will be performed to determine the contribution of various types of fine particles to visibility reduction and to determine the sources of the particles. Laboratory and field studies will be performed to identify and determine the significance of the volatile component. Visibility models will be developed.

Research on the effects of particles on materials will concentrate on the influence of particle size and composition on the soiling of paint.

Under the Monitoring Systems and Quality Assurance portion of this program, improved air pollution monitoring methods are being developed to help determine air quality trends, support compliance with standards, and meet enforcement needs. The data from these methods are often used as the basis for regulatory action. The areas investigated include ambient methods development, quality assurance guidelines and audit materials preparation.

Ambient methods development will focus on measuring particulate matter in support of anticipated changes to the National Ambient Air Quality Standards (NAAQS). EPA researchers will continue to analyze the mass and chemical composition of the particulates collected through the Inhalable Particulate Network. Also, fiber filters from the national, state, and local air monitoring stations will be analyzed for trace metals and benzo-a-pyrene.

Quality Assurance (QA) support will be provided through a standards laboratory and repository of quality

assurance materials. Routine and special audits will be conducted at laboratories making ambient measurements and at compressed gas vendors. QA guidelines, handbooks, data handling systems and a precision and accuracy reporting system will be maintained and updated. QA procedures, materials, and audit techniques will be developed for compliance monitoring. LIDAR support will continue to be provided to field studies in plume/air mass transport.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/RTP	John Puzak	2,904.0	57
EMSL/LV	James McElroy	780.5	24
ADEMQA/HQ	J. M. Shackelford	193.3	77
ASRL/RTP (CTF)	Alfred Ellison	386.6	23

National Ambient Air Quality Standards (NAAQS)

Health Effects

This research program has three major goals: (1) to provide data on health effects of exposures to O_3, NO_2, sulfur oxides, particles, and lead using both human and animal studies; (2) to provide better models to extrapolate animal data to human effects; and (3) to develop improved test methods for research into the physiological responses of humans to gaseous air pollutants and particles.

Health Effects Research is conducted to refine and improve the toxicological data base relevant to a size-resolved particle standard (i.e., PM_{10}). Fine-mode particles (<10 micron) will be studied in normal and susceptible human and animal populations, as appropriate. Both human and animal-dose response studies, as well as mathematical modeling, will be given special attention to determine the deposition, clearance, and pulmonary function effects of particles, alone and in combination with ozone, NO_2 and SO_2.

The neurological consequences of lead, especially at levels previously considered to be safe in children will be studied epidemiologically, supplemented with animal studies where needed. Research will also be done to improve the models used to extrapolate animal biochemical and metabolic responses to human effects. Both human and animal experiments will provide data on the functional, morphological, and biochemical changes which occur following exposures to the primary air pollutants, and provide extrapolation techniques to predict human pulmonary and morphological responses to gases and particles.

Air

This research provides data on the degree to which primary air pollution cause or exacerbate the development of non-carcinogenic chronic disease. Animal, human clinical, and epidemiology studies are performed. Biological endpoints to be examined include development of cardiovascular or pulmonary disease, aggravation of existing conditions, changes in biochemistry and host defense mechanisms, and changes in pulmonary structure or function. Emphasis is currently placed on determining the acute and chronic effects of O_3 and NO_2 inhalation.

The heath effects data from this research program are incorporated into EPA criteria documents which are used to set and revise National Ambient Air Quality Standards (NAAQS).

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP OHR/HQ	Richard Dickerson Frode Ulvedal	12,496.9	38

National Ambient Air Quality Standards (NAAQS)

Environmental Processes and Effects

Research will continue to determine impacts on crop yield due to crop cultivar (genotype) and climate influence and dynamics (such as moisture) of varying ozone exposure patterns during the growing season. Crop yield reductions and soil moisture interactions with exposure dynamics will be emphasized. Process directed studies will develop conceptual or predictive models to define multiple interactions between levels of various stress factors. Field validated models will be used to predict yield effects of single or multiple experimental variables. Preliminary research design of ozone impacts on selected forest species will be undertaken.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/COR OEPER/HQ	Dave Tingey Kenneth Hood	1,658.7	40

National Ambient Air Quality Standards (NAAQS)

Scientific Assessment

The main objective of the NAAQS scientific assessment program is to review and revise criteria documents for sulfur oxides, particulate matter, nitrogen oxides, ozone and other photochemical oxidants, carbon monoxide and lead.

Air

Criteria documents are mandated by the Clean Air Act and, as directed by the Act, are revised at 5-year intervals. These documents are evaluations of the available scientific information on the health and welfare effects of criteria pollutants. As such, criteria documents are the primary source of information used by EPA regulatory decision makers in setting or revising the NAAQS.

Criteria document draft materials are developed by EPA scientists and outside expert consultants and are peer-reviewed by scientific experts in public workshops. Subsequently, the document drafts are revised and, through announcements in the Federal Register, the public is invited to comment on the resulting external review drafts, which are also reviewed in public meetings by the Clean Air Scientific Advisory Committee of EPA's Science Advisory Board. The final documents are submitted to the Clean Air Docket and are published concurrently with the proposed regulatory decisions.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/RTP	Lester Grant	1,656	49

New Source Performance Standards and State Implementation Plans

Acid Deposition Environmental Monitoring and Quality Assurance

Air quality models predicting the air quality impacts associated with pollution abatement strategies are used in the evaluation and development of State Implementation Plans for the control of photochemical oxidants and gases and particles.

The Characterization, Transport, and Fate portion of this program is responsible for the conduct of air quality modeling studies to develop a single, defensible chemical mechanism module for use in ozone air quality simulation models. Regional ozone air quality models are being developed for use in secondary ozone air quality standard development and to provide a simpler regional ozone model.

Field and laboratory studies to further develop and test different Source Apportionment Methods (SAMs) are underway and will evaluate hybrid (chemical composition and meteorology) SAMs for apportionment of regional aerosols. In anticipation of a revised particulate air quality standard based on inhalable particulates, field, smog chamber, wind tunnel, water channel, and laboratory studies are being used to develop and evaluate chemistry

and dispersion components of urban scale particulate air quality models. Research is continuing to develop a first generation regional particulate air quality model (RPM). Cooperative transport and fate studies with the Peoples Republic of China will continue. The User's Network for Applied Modeling of Air Pollution (UNAMAP) program is continuing to evaluate models to prepare computer programs for new versions of UNAMAP, prepare user's guides and supplements, and provide modeling consultation to users. Field, wind tunnel, and modeling studies are being used to develop the first generation SO_2 Complex Terrain Dispersion Model. Fluid modeling studies are being conducted on the flow in the wake of buildings.

Additional research activities in the Monitoring Systems and Quality Assurance area emphasize the development of monitoring methods and provision of quality assurance samples and support. EPA's monitoring methodologies for source air pollutants will include evaluation, methods improvement, preparation of operating guidance and manuals for developed and commercial monitoring instruments. Quality Assurance for the source monitoring program is essential to ensuring that the data of known accuracy and precision are used for regulatory and enforcement decisions. Reference samples will be provided and audits of laboratories making source measurements will be continued.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/RTP	John Puzak	1,115.0	39
EMSL/LV	James McElroy	425.6	77
ADEMQA/HQ	J. M. Shackelford	0	0
ASRL/RTP (CTF)	Alfred Ellison	7,216.5	30
ADEMQA/HQ (CTF)	William Keith	526.8	55

New Source Performance Standards and State Implementation Plans

Environmental Engineering and Technology

Research in this program supports the development of New Source Performance Standards (NSPS) and State Implementation Plans by aiding in the development of pollutant control technology which is cost-effective and energy-efficient. The focus of the research is on the reduction of VOC, NO_x, SO_x, and particulate emissions.

Volatile Organic Compounds (VOCs) are a major cause of non-attainment of National Ambient Air Quality Standards. Extramural research will evaluate VOC

abatement technology such as adsorption, thermal oxidation, and catalytic oxidation. Of particular interest will be effective and affordable control methods for small VOC-emitting industries. Field tests of process modifications for VOC emission reduction from printing and coating operations will be conducted jointly with industry.

Combustion modification methods of controlling NO_x and other emissions will be evaluated to determine combustion modification (CM) methods for reducing NO_x emissions and improving the performance of utility and industrial boilers. Prior research has proven the CM methods can be effective for control of NO_x as well as other emissions, if each method is tailored to the characteristics of the specific combustion equipment (e.g., stoker or package boilers, coal or oil burners, and internal combustion engines or gas turbines). Research will continue to assess low NO_x heavy oil burner (precombustor) technology for industrial boilers and the combustion of highly nitrated waste fuels. Further, research will evaluate an in-furnace NO_x reduction technique called reburning which involves injection of fuel downstream of the primary combustion zone. In-house reburning experiments on pilot-scale combustors will be continued and field test projects in a full-scale coal-fired utility boiler will be started. In-house tests of selective catalytic reduction (SCR) systems for internal combustion engines will be completed.

Fundamental research on combustion processes will also be conducted to improve the technical basis for estimating achievable emissions, to help develop NO_x-SO_x emissions reduction technologies and to support development of emission standards for gas, oil, and coal-fired combustors.

Existing technology to control gaseous and particulate pollutants is expensive. For new utility sources, approximately 30% of boiler costs are attributable to air pollution control. Design and performance data for low costs, high-reliability emission reduction technology are needed to support the Agency's regulatory functions. Technical support to regulated entities will be provided by conducting assessments and fundamental research on technologies for reduction of stack emissions of sulfur dioxide (SO_x) and particulate matter (PM), as well as PM fugitive emissions.

SO_x emissions reduction technology: In-house pilot efforts will emphasize evaluation of low cost, more active sorbents and additives for spray drying and other dry scrubbing systems. A symposium on SO_x emission reduction via flue gas cleanup will be conducted.

Air

PM emissions reduction technology: In-house laboratory and pilot efforts will emphasize investigation of advanced concepts for lowering the costs of particulate control baghouses and electrostatic precipitators (ESPs). The range of work will include electrostatic augmentation of fabric filters (baghouses), larger diameter electrodes for ESPs, and simultaneous particulate/SO_x removal in existing ESPs. Extramural studies of controlling condensation aerosols and fugitive emissions will also be conducted.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	Everett Plyler W. Gene Tucker Robert E. Hall	2,480.9	50
OEET/HQ	Marshall Dick	0	0

Drinking Water

Health Effects of Drinking Water Contaminants

Health Effects

This research program provides dose-response data on organic, inorganic, and microbiological contaminants. It provides information on the best methods to obtain that data, and information on the best methods to perform risk assessments.

Selected contaminants will be evaluated to assist in setting maximum contaminant levels or developing health advisories. Increasing emphasis will be on determining the health effects of exposure to disinfectants and their by-products. Work will be done to improve methods for extrapolating health effects research data in order to assess the risks associated with simultaneous exposure to multiple chemicals in complex mixtures. Focus will also be on concentrating, isolating, and identifying infectious disease agents in drinking water. Epidemiology studies on the relationship between disinfectants and cardiovascular disease and another study designed to determine the significance of low-levels of viruses to human health are underway.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL CIN	Elmer Akin	9,692.7	35
OHR HQ	David Kleffman		

Health Effects of Drinking Water Contaminants

Scientific Assessment

Revision of national drinking water regulations and health advisory guidance given to the states requires an assessment of the potential hazard to human health from exposure to chemicals in drinking water. The health assessment documents prepared under this program take the form of both criteria documents and health advisories. These documents are assessments of the health effects of exposure to contaminants in drinking water. They specifically evaluate the relevant scientific data describing the physical and chemical properties, the pharmacokinetics, the health effects in animals and humans, and the mechanisms of toxicity. The health assessments are prepared for various chemicals as requested by EPA's Office of Drinking Water (ODW). This risk assessment process enables ODW to establish a Recommended Maximum Contaminant Level (RMCL) or health goal, representing a level designated to preclude the risk of an adverse effect on human health.

Drinking Water

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/CIN	Cynthia Sonich-Mullin	647	62

Acid Deposition Environmental Monitoring and Quality Assurance

Groundwater

This program will provide development of methods for locating abandoned wells, develop geophysical methods to detect and evaluate underground movement of fluids from injection wells and evaluate existing instruments and conduct research to develop new and advanced fiber optic techniques for monitoring groundwater. The program will also investigate the effects of seasonal variability on monitoring well network design(s). In addition, accurate and reliable total measurement systems will be developed through standardized methods, laboratory evaluation, and quality control procedures.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	Erich Bretthauer	934.6	35
ADEMQA/HQ	Vernon J. Laurie	31.8	85

Environmental Processes and Effects

Groundwater

Ground water is a major source of drinking water for the nation. This research program seeks to improve methods for determining the transport and transformation of contaminants in the subsurface, methods for predicting the behavior of pollutants in aquifers based on site-specific subsurface characteristics and on characteristics of the pollutants. In addition, research will evaluate in-situ aquifer reclamation methods.

Extramural efforts will be directed toward several areas. Methods will be developed for determining not only the quantity and type of subsurface microorganisms, but also their activity in terms of potential for biotransformation of pollutants. Methods will also be developed for in-situ detection of other subsurface parameters, important to predicting pollutant behavior. Biological, physical/chemical, and hydrologic processes and their interrelations that will included in models. Subsurface (site-specific) characteristics that influence such processes will be determined.

Drinking Water

Promising reclamation methods (e.g., biotransformation) will be studied at laboratory scale and evaluated at one field site. Finally, information transfer activities will be continued.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RSKERL/ADA	George Keeler	4,695	25
OEPER/HQ	Steve Cordle	298	36

Drinking Water Technology

Acid Deposition Environmental Monitoring and Quality Assurance

This program will provide support for the Agency-wide mandatory quality assurance program. The ten regional laboratories will be evaluated annually in support of the National Interim Primary Drinking Water Regulations monitoring certification program. This program will also conduct methods development research and provide analytical procedures to produce precise and accurate total measurement systems for chemical, radiochemical and microbiological analysis. It will provide technically and economically feasible analytical procedures to monitor contaminants for use by the Agency, States, municipalities, and operators of public drinking water systems.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	Robert Booth	1,436.3	45
EMSL/LV	Erich Bretthauer	329.8	95
ADEMQA/HQ	Vernon Laurie	64.1	95

Drinking Water Technology

Environmental Engineering and Technology

To support revision of the national drinking water standards, this program provides data on the technologies available, what they can attain in terms of drinking water quality, and what they cost. Focus is on removal of volatile organic compounds, organics responsible for formation of trihalomethanes, inorganic and microbiological contaminants and on problems related to maintaining water quality in distribution systems. Emphasis will be on developing cost information for treatment processes and for entire water systems. Evaluation will also be made of the tradeoffs in planning for rehabilitation of older water systems. In addition, efforts will be made to address the

Drinking Water

problems of small utilities and to assist the states and municipalities in complying with maximum contaminant levels.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
WERL/CIN	Robert Clark	4,291.8	68
OEET/HQ	Bala Krishnan	0	0

Water Quality

Water Quality Based Approach/Permitting

Acid Deposition Environmental Monitoring and Quality Assurance

The monitoring research program develops chemical, physical, and biological methods for measuring site-specific and ambient water pollution concentrations. Most of this research is conducted in-house at EMSL-Cincinnati with a small portion being conducted at EMSL-LV.

Research emphasizes chemical measurement method standardization and development of quality assurance methods for priority toxic pollutants. Addtionally, research seeks to extend the sensitivity of methods for measuring toxic metals in water. Research on biological monitoring methods addresses methods for screening toxic concentrations of pollutants in ambient waters, characterizing the biological condition of ambient waters, provision of quality assurance procedures to analyze chronic and acute toxicological effects, and standardization of microbial and viral sampling and analysis methods. Research on physical measurement methods concentrates on documenting the validity and accuracy of sampling regimes and flow-sensing equipment. The quality assurance program provides quality control calibration materials and procedures for standardization of chemical and biological analysis. Virus sample preservation and assay protocols will be standardized.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL-CIN	Cornelius Weber James Lichtenberg John Winter	2,027.5	99
ADEMQA/HQ	Charles Plost	90.5	89

Water Quality Based Approach/Permitting

Environmental Processes and Effects

A water quality-based approach to pollution control provides for correction of ambient water quality problems that remain after mandated minimum pollution control technology (e.g., secondary treatment, effluent guidelines) is in place. This requires the ability to translate water quality standards into specific effluent conditions and discharge limitations for municipalities and industry. Research will be undertaken to provide the necessary information base and scientific tools, including: site-specific criteria modification protocols; contaminated sediment assessment techniques; wasteload allocation techniques; complex effluent bioassays; biomonitoring methods; and use attainability

analyses. Research on wetland impact mitigation and cumulative effects will also be conducted.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL ATH	Robert Swank	1,455	69
ERL COR	Spencer Peterson	815	75
ERL DUL	Nelson Thomas	2,885	97
ERL NARR	Norbert Jaworski	845	96
OEPER HQ	Douglas Lipka	425	98

Water Quality Based Approach/Permitting

Health Effects

Investigators will use existing short-term tests for carcinogenic, mutagenic, and reproductive effects to determine whether or not a site receiving a large number of chemical contaminants into ambient waters is a public health risk. Health effect indicators for shellfish growing waters, are being developed. The results of these studies will be used to revise and update water quality criteria and NPDES permits.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/CIN	Lyman Condie	931.0	36
OHR/HQ	David Kleffman		

Water Quality Based Approach/Permitting

Scientific Assessment

EPA's overall research program with regard to water quality emphasizes development of the scientific and technical base to help states develop site-specific standards and to conduct use-attainability analyses. The scientific assessment program will provide guidance for assessing the risk of human exposure to mixtures of toxic chemicals, evaluate site-specific health hazards as required by the states and EPA, and prepare evaluations of NPDES permit modification requests submitted Section 301(g) of the Clean Water Act.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/CIN	Cynthia Sonich-Mullin	290	68

Water Quality

Wastewater Treatment Technology

Acid Deposition Environmental Monitoring and Quality Assurance

Research will support the Agency in the implementation of technology-based effluent limitation regulations and the modification of enforcement activities as required by water quality-based permit adjustments. Methods standardization research will be directed to the improvement of precision, accuracy, and method detection limit of existing regulated organic contaminants. Research will also validate and correct analytical methods for the analysis of high priority industrial wastewater components as well as evaluate alternative analytical methods to support the National Pollution Discharge Elimination System (NPDES) program.

Quality Assurance activities include the Discharge Monitoring Report Quality Assurance (DMRQA) study; preparation and distribution of calibration repository, quality control, and performance evaluation samples; and the conduct of performance evaluation studies. The research program will support NPDES quality assurance by providing quality control samples and protocols and by maintaining the standards repository, including auditing monitoring systems data reliability, DMRQA and documentation of its precision and accuracy.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	James Lichtenberg John Winter	1,087.9	100
ADEMQA/HQ	Charles Plost	112.6	100

Wastewater Treatment Technology

Environmental Engineering and Technology

Revisions to the Clean Water Act provide incentives for the use of innovative wastewater treatment technology. This research program will provide engineering support to the innovative technologies and sludge management programs, and on techniques to improve the reliability of wastewater treatment plants.

In the area of innovative/alternative (I/A) technologies, assistance will be provided to the construction grants program in reviewing project plans, recommending innovative technologies, and in making available detailed planning, engineering, and analytical assistance for innovative technology. Technical evaluations of full-scale operational projects will produce feedback information of designing, energy, capital, and operation and maintenance

costs. Also, a new effort will evaluate reasons for failure of I/A projects for the 100% modification/replacement provisions.

Engineering support of municipal sludge management is provided in two areas—treatment and disposal. In the treatment area, emphasis will be on innovative stabilization, digestion, and thermal conversion processes that are more efficient in reducing the volume of sludge. Research in the disposal area will focus on characterizing the mechanisms controlling the uptake and the transformation of toxic organics and pathogenic organisms in sludge-amended soils. Overall emphasis is to provide the engineering information on sludge management options to support implementation of the Agency's new sludge disposal regulations.

In the compliance achievement support program, emphasis will be on providing design and cost information on two low cost upgrading methods through the integration of high biomass reactors and improved air aeration technology.

Evaluations of the toxics treatability of various municipal processes will be carried out. Toxicity reduction evaluation procedures will be developed to support the Agency's "Policy for Development of Water Quality-Based Permit Limitations."

This program also supports Agency regulatory activities relating to control of specific pollutants or toxicity in industrial wastewater discharges. Efforts will supply data to enable permitting authorities to issue BPJ discharge permits for industry to meet water quality based standards in the most cost-effective manner possible. This will be accomplished by means of laboratory and pilot plant scale evaluations of biological (particularly anaerobic) and physical/chemical wastewater treatment methods. This work will focus on complex, highly toxic wastewaters such as dye and pigment manufacturing, aluminum smelters, and organic chemicals production.

Also, efforts will provide manuals and methods for conducting site-specific toxicity reduction evaluations (TREs) to be used by permitting authorities to issue discharge permits to industry, based on a toxicity as a major parameter, particularly in the case of multiple industrial contributions. The TRE method will be developed by identifying the inplant sources of aquatic toxicity, measuring stream toxicity, identifying industrial contributors and recommending control alternatives. The complete method will be verified at specific sites in conjunction with ADEMQA and is applicable to complex effluents not easily controlled by the WQA chemical-by-chemical approach. Initial efforts will include toxicity

reduction for pesticide manufacture, inorganic chemicals and petrochemicals.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
WERL/CIN	Carl Brunner Fred Bishop Joseph Farrell James Kreissl Lew Rossman Clyde Dempsey	659.4	82
OEET/HQ	Bala Krishnan Don Tang	0	0

Wastewater Treatment Technology

Environmental Processes and Effects

This research will identify and determine distribution of unlisted chemicals in industrial wastewaters. Compounds that can be identified by empirical mass spectra matching as well as those that elude identification by this technique will be included.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/ATH OEPER/HQ	William Donaldson Chieh Wu	470	58

Wastewater Treatment Technology

Health Effects

Health effects research focuses on human health aspects of municipal sludge disposal. The data from these studies are used by the Agency for formulation of regulations, permits, and guidelines under the Clean Water Act. One emphasis, at present, is on land use and disposal of municipal sludges which requires careful assessment of the effects on human health of exposure to pollutants contained in the sludges. Research will focus on the fate of pathogenic organisms, particularly parasites and viruses, and on toxic risks of heavy metals and organic chemicals. A critical aspect of human exposure to municipal sludges is the potential close human contact from sludge distribution and marketing systems. Studies of the occurrence of pathogens and chemicals in these systems are underway. Information from

these studies will be part of a determination of the feasibility of epidemiological evaluation of risks to the human population from sludge distribution and marketing.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL CIN OHR HQ	Elmer Akin David Kleffman	1,158.0	75

Wastewater Treatment Technology

Scientific Assessment

The scientific assessment program provides health assessment profiles to support regulatory decision making on the effective treatment, conversion, use, and disposal of municipal sludge. Preliminary data profiles and hazard indices are being prepared for a number of contaminants of municipal sludge.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/CIN	Cynthia Sonich-Mullin	388	25

Marine, Estuaries, and Lakes

Environmental Processes and Effects

This program has three components: ocean disposal, estuaries, and Great Lakes.

To support ocean disposal permit decisions, there is a need to provide decision makers with rationale and procedures which are scientifically sound. These should provide guidance for the acquisition of information and the interpretation of this information in order to support ocean disposal permit decisions. Under the ocean disposal research program, emphasis will be given to the development and testing of procedures to better evaluate the impacts of ocean disposal actions; development of procedures to satisfy monitoring needs for permit, surveillance, and hazard assessment application; and development of procedures for predicting the bioaccumulation of contaminants and evaluation of the significance of bioaccumulation processes, resultant tissue residues and biological effects.

Methods for better source control decisions in the NPDES and construction grants program are needed for estuaries. The research program is developing generic

procedures for conducting wasteload allocations in estuaries. These generic methods are being developed using data intensive case studies.

The Great Lakes research program will measure, describe and predict the distribution, movement, fate, and effects of toxic substances in nearshore "areas of concern" identified by the US/Canada Water Quality Agreement. Emphasis will be given to problems involving in-place pollutants. This program will also provide the International Joint Commission (IJC), the Great Lakes National Program Office (GLNPO), EPA Regions and Great Lakes states with technical support and research data synthesis related to activities under the US/Canada Water Quality Agreement.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/NARR	Norbert Jaworski	3,690	84
ERL/GB	Thomas Duke	265	76
ERL/DUL	Gil Veith	930	46
OEPER/HQ	Sam Williams	170	63

Marine, Estuaries, and Lakes

Environmental Engineering and Technology

This program develops data correlating sludge treatment processes with environmental impacts for use in determining appropriate treatment levels for sludge prior to ocean dumping as well as treatment levels for wastewater discharged through ocean outfalls.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
WERL/CI	Fred Bishop	66.8	100
OEET/HQ	Bala Krishnan	0	0

Hazardous Waste

Alternate Technologies

Environmental Engineering and Technology

The treatment program examines both existing and emerging alternative techniques for treating or detoxifying hazardous materials. Emphasis continues to be placed on those waste streams which will be banned from land disposal facilities.

Research is being conducted to evaluate in-situ methods for the destruction/detoxification/containment of dioxins/furans and pollutants related to the production dioxins and similar toxicants. Major investigation will involve the accelerated evaluation of the mobile incinerator at the Denney Farm site near Verona, Missouri, and destruction tests of potassium polyethylene glycolates (KPEG) on wood treating wastes in Montana. The purpose of this research is to determine the economic viability of the technique and to establish: (a) test burn protocols; (b) health and safety protocol; (c) site-specific, risk assessment protocol; (d) an economic model for estimating the cost of treatment per unit of material processed; and (e) national and state permit protocol.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HWERL/CIN	C. Dial A. Klee I. Wilder	6,433.8	24
OEET/HQ	P. E. desRosiers	0	0

Dioxin

Environmental Processes and Effects

The research is designed to provide techniques and necessary data for predicting the rate and extent of movement and transformation of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) and selected isomers in soils and ground waters. Also, the bioavailability of dioxins is evaluated and the potential for uptake of dioxins by plants, fish, and large animals is determined for defining the potential biomagnification in food chain systems.

ERL/Athens is evaluating the photodegradation of 2,3,7,8-TCDD in soils. RSKERL/Ada, using saturated and unsaturated zone microcosms with soils from actual contaminated sites, is determining the degradation and mobility of 2,3,7,8-TCDD and isomers in soils. ERL/Duluth is studying the bioavailability to fish of dioxin and selected isomers from contaminated sediments, while the program at ERL/Corvallis deals with comparative plant uptake kinetics and the potential bioaccumulation of 2,3,7,8-TCDD from contaminated soils in large animals.

Hazardous Waste

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/ATH	Rosemarie C. Russo	75.0	0
RSKERL/ADA	Harold G. Keeler	299.7	29
ERL/DUL	Philip M. Cook	424.1	18
ERL/COR	Harold Kibby	184.3	29

Dioxin

Health Effects

The purpose of the dioxin health research program is to provide improved methodologies and assessments for prediction of toxicity and exposure to halogenated dioxins, furans, and related compounds. Tetrachlorodibenzodioxin (TCDD) and some of its presently uncharacterized congeners are among the most highly toxic compounds. This research program is designed to improve the scientific methodology for detection of these toxins and characterization of their effects. Specific areas of research are the investigation of the effects of polychlorinated dibenzodioxins and dibenzofurans on the immune system and serum chloresterol. In addition, the structure-activity relationship of various congeners to specific biological activity will be determined.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Richard Phillips	500.0	0
OHR/HQ	W. Wade Talbot		

Dioxin

Scientific Assessment

This program supports the activities of the Agency's dioxin program through research designed to fill gaps in the Agency's information base on dioxins in order to reduce the uncertainties in dioxin risk assessments. The specific projects include analysis of soil ingestion patterns in children, investigation of the pharmacokinetics of 2,3,7,8-TCDD in rhesus monkeys as a model for pharmacokinetics in humans, and determination of the physical and chemical properties of the most overt congeners of dioxins and furans.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OHEA/HQ	Alan Ehrlich	488	10

Hazardous Waste

Incineration

Environmental Engineering and Technology

Incineration research focuses on four areas: characterizing performance of existing thermal destruction technologies; developing methods of rapid cost-effective compliance monitoring of these facilities; characterizing the products of incomplete combustion and their formation conditions; and developing methods to predict performance to avoid process failure and control process reliability. The research is conducted at laboratory and pilot-scale facilities in Cincinnati, Research Triangle Park, and Jefferson, Arkansas. The hypotheses from this program are verified in full-scale field tests. The program examines conventional incineration as well as high temperature industrial processes.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HWERL/CIN	E. Oppelt	2,578.5	41
OEET/HQ	K. Jakobson	0	0

Land Disposal

Environmental Engineering and Technology

With regard to land disposal, synthetic and clay liners will be studied and the effectiveness of alternative closure and monitoring procedures for surface impoundments will be investigated. Technical Resource Documents will be updated for use by regional and state agencies for permitting hazardous waste disposal facilities and for enforcing applicable regulations. This program will update documents for disposal facility design, operation, maintenance, and closure.

Research is also being conducted to characterize air emissions from hazardous waste treatment, storage, and disposal facilities and to assess methods to control them.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HWERL/CIN	N. Schomaker	2,883	34
OEET/HQ	K. Jakobson	0	2

Land Disposal

Environmental Processes and Effects

The goal of this research is to develop information on new and existing technologies for land treatment of hazardous wastes for which incineration or conventional land disposal are inappropriate, infeasible, or ineffective. In addition, the Land Treatment Permitting Standards require all applicants

show that hazardous constituents can be degraded, transformed, or immobilized in the treatment zone.

Through the design and operation of laboratory-, bench-, and pilot-scale land treatment systems, RSKERL/Ada is studying the effects of waste mixtures, closure approaches, treatment zone limitations, runoff control, volatilization, loading rates, and unsaturated zone monitoring. Training manuals for permit writers and applicants are produced from these studies.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RSKERL/ADA	Harold G. Keeler	768.0	37

Quality Assurance

Acid Deposition Environmental Monitoring and Quality Assurance

To ensure that the data on which regulations and enforcement are based are accurate, QC samples will be provided to USEPA contractor, state, and local laboratories conducting RCRA monitoring. Calibration standards will be provided for Appendix VIII compounds to USEPA contractor, state, and local laboratories. Natural matrix, liquid and solid performance evaluation samples will be developed and distributed to RCRA contractors, EPA, and state laboratories conducting RCRA hazardous waste analyses. Statistical data on the laboratory evaluations will be reported to the Office of Solid Waste. Referee laboratory analyses on all RCRA samples will be conducted. NBS traceability for PE, QC, and method validation study samples prepared for RCRA monitoring activities will be provided.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	Robert Booth	589.7	26
EMSL/LV	Erich Bretthauer	667.5	28
EMSL/RTP	John Puzak	165.9	18
ADEMQA/HQ	John Koutsandreas	50.0	10

Releases

Acid Deposition Environmental Monitoring and Quality Assurance

In order to determine whether underground storage tanks (UST) containing hazardous materials are leaking, an evaluation of basic leak detection monitoring methods for outside UST will be conducted. This will include: the establishment of candidate performance criteria for several classes of techniques; the development of a test protocol for determination of the performance criteria; and testing of the

"most promising" leak detection methods to validate the test procedure and to establish that instrumentation presently exists which can meet the candidate performance criteria.

Network design for the placement of leak detection sensors will focus on the excavation zone around tanks with emphasis on vapor monitoring. However, monitoring in the saturated zone and in native soils will also be considered. Field measurements will be conducted and existing private and local/state experiences with leak detection will be investigated. Technical guidance will use a panel of experts to develop a "decision tree" approach to provide guidance for the many and varied sites throughout the country. New technologies for leak detection monitoring, such as fiber optics and geochemical sensors, will be evaluated.

The Clean Water Act (Section 311) mandates that Spill Prevention Control and Countermeasure plans be prepared for all facilities engaged in the production, storage, processing, and distribution of hazardous materials. EPA regional offices are responsible for ensuring compliance. The ADEMQA provides remote sensing techniques for monitoring. Support will be provided to the Regions for the development and revision of monitoring techniques.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	Erich Bretthauer	1,556.1	15
ADEMQA/HQ	John Koutsandreas	23.1	10

Releases

Environmental Engineering and Technology

Underground storage tank (UST) research is evaluating prevention, detection, and corrective action technologies to identify cost-effective, reliable techniques and equipment for USTs. Early work is producing state-of-the-art documents for each type of technology. The primary focus of ongoing work is the evaluation of leak detection technologies at a test apparatus in Edison, NJ, and the targeting of high potential technologies for improved performance. Best engineering practices for leak prevention, the detection of leaks, and site cleanup will be documented.

To provide technical support in preventing and containing hazardous spills, reports will be issued summarizing research on the evaluation of specialized equipment and techniques for prevention, control, removal, and disposal of hazardous releases.

Hazardous Waste

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HWERL/CIN	I. Wilder	3,052.4	21
OEET/HQ	D. Berg K. Jakobson	0	0

Releases

Environmental Processes and Effects

Within this activity, research is conducted to address evaluation of assessment and cleanup techniques for unplanned releases of hazardous wastes. This includes the development and evaluation of a multiple bioassay screening protocol to indicate the biological hazard associated with contaminated soils, water, and sediment; and the determination of the applicability and cost-effectiveness of *in-situ* reclamation techniques for unsaturated-zone and ground-water contamination resulting from leaking underground storage tanks and other hazardous waste sources.

ERL/Corvallis has developed and is now testing and field evaluating a multimedia, multiorganism bioassay designed to indicate whether the toxicants in contaminated water, soil, and sediments are biologically available and if the level of bioavailability poses a significant risk to exposed organisms in the environment. At RSKERL/Ada, coordinated laboratory and field tests of biological, physical, and chemical methods, previously tried at hazardous waste sites, are being conducted to determine their cost and applicability to cleanup of pollutants from leaking underground storage tanks.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/COR	Spencer A. Peterson	352.6	80
RSKERL/ADA	Harold G. Keeler	348.7	42

Waste Characterization

Environmental Processes and Effects

Regulation of hazardous wastes in the most cost-effective manner requires methods and data for predicting toxicity of waste materials and evaluating the concentrations of these materials at some point of exposure, and then integrating these methods for different media into single evaluation techniques which incorporate uncertainty into the predictions.

Hazardous Waste

ERL/Duluth is developing methods and data for rapidly predicting the toxicity and bioaccumulation potential of wastes, waste streams, and leachates on the basis of quantitative chemical structure-activity relationships. This is achieved by linking chemical molecular descriptors with known toxicities of single chemicals and chemical classes, developing a model to predict toxicity of chemical mixtures on the basis of individual components, identifying modes of action of chemical types, and comparing fish dose/response relationships to those of mammalian species.

Providing field-evaluated methods and data to predict the concentrations of hazardous chemicals in the subsurface environment from the treatment, storage, or disposal of wastes is the thrust of the program at RSKERL/Ada. Physical, chemical, and biological processes that govern the transport rate, transformation, and fate of wastes are evaluated and their mechanisms are described in mathematical models. These, in turn, are evaluated through field experiments.

Integrated, multimedia mathematical models and data are being developed by ERL/Athens for implementing the land disposal banning rule and evaluating waste management and treatment needs based on potential human health and environmental impacts. Probabilistic techniques are developed and used to address uncertainty. The various media models are coupled to produce both screening-level and more site-specific multimedia exposure assessment packages.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/DUL	Philip M. Cook	1,185.2	55
RSKERL/ADA	Harold G. Keeler	2,380.6	32
ERL/ATH	Rosemarie C. Russo	3,062.5	17
OEPER/HQ	Will C. LaVeille	594.4	45

Waste Characterization

Health Effects

Listing of substances under the Resource Conservation and Recovery Act (RCRA) requires the ability to characterize the potential health hazards of wastes. This research program focuses on developing a three-level biological testing battery of short-term tests to make determinations of the potential health hazard of manufacturing process residues. Emphasis will be on recognizing complex mixtures

as hazardous wastes for disposal purposes. This current research is to develop a screen for Level I of a three-level testing battery. This prescreen protocol will be an abbreviated and inexpensive screen for large numbers of RCRA samples. The screen will provide a rapid and sensitive prioritizing assessment of the potential toxicity of RCRA samples. In 1987, the program will begin validating the use of the prescreen protocol on actual field samples from hazardous waste sites.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP OHR/HQ	Richard Phillips W. Wade Talbot	1,903.7	34

Waste Characterization

Scientific Assessment

This program provides assessments of the health effects and risks arising from hazardous wastes, improved methods for performing such assessments, and chemical-specific health summaries. These are supplied to the EPA's Office of Solid Waste (OSW) to support a variety of regulatory activities and to EPA regional offices, and the states for use in evaluating permit and enforcement actions.

One type of assessment, the health and environmental effects profile, characterizes a waste and assesses the hazards posed to humans or the environment by exposure to it. The profiles support decisions on listing or delisting a chemical as a hazardous waste. Most of this work is done by extramural contract.

In addition, the program develops methods to assess the extent of human health effects and human exposure to complex hazardous wastes. These methods support efforts to assess and refine proposed RCRA permits and to prepare supporting documentation for enforcement decisions. Finally, to support the prevention and containment of hazardous spills, extramural contractors develop chemical-specific health summaries for use in evaluating alternatives for dealing with hazardous spill contaminants.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/CIN	Christopher DeRosa	3,653	33

Hazardous Waste

Waste Identification

Acid Deposition Environmental Monitoring and Quality Assurance

To improve procedures to characterize wastes for listing under RCRA, research will be conducted to develop methods for characterizing and detecting particular wastes and providing criteria for determining if those wastes constitute a potential hazard. The lack of standardized methods emphasizes the immediate need for a comprehensive program to assure that data of known quality are being collected. Methods will be tested for application to highly toxic wastes in soil and sediments, for detection of organics in the ambient air of waste disposal facilities, and for determining the reactions of wastes in all media.

Techniques for field monitoring of waste sites will be improved, including statistics for sampling design and evaluated standard methods. RCRA land disposal regulations require the establishment of a ground water monitoring program at most facilities, including detection and compliance of saturated and vadose zone monitoring. Of particular importance is subsurface monitoring of sites and investigation of new techniques for monitoring soils, biota, ambient air, and waste incineration emissions.

Efforts will be directed toward validating waste incinerator test methods for semi-volatile organic compounds and monitors for carbon monoxide and organics on waste incinerator stacks.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	Robert Booth	1,958.3	25
EMSL/LV	Erich Bretthauer	7,249.6	27
EMSL/RTP	John Puzak	936.7	21
ADEMQA/HQ	John Koutsandreas	100.0	15

Toxic Chemical Testing/Assessment

Biotechnology/Microbial and Biochemical Pest Control Agents

Environmental Engineering and Technology

The areas of focus in this research program are: the identification and evaluation of alternatives to mitigate release and exposure of chemicals which will be used by the Agency in regulating the manufacture and use of existing chemicals; the development of predictive capabilities to be used in assessing release and exposure in the review of Premanufacturing Notices (PMNs) for new chemicals as required by TSCA; and the assessment of physical, chemical and biological techniques and devices to contain and destroy genetically engineered organisms under TSCA.

Alternatives to mitigate release and exposure of specific existing chemicals will be defined in cooperation with industry, through the evaluation and adaptation of control measures related to the release in the workplace and into the environment of the chemicals during their life cycles. Technologies, management practices, and personal protective equipment to limit the release and exposure of chemicals will be evaluated.

Models to predict the release and exposure of different classes of new chemicals will be developed in cooperation with industry. The models will address different chemical unit operations, unit processes and physical/chemical properties of chemicals and predict potential exposure and release levels as well as best control measures to mitigate release and exposure of new chemicals. Pilot scale testing for the treatability of classes of potentially toxic chemicals will be conducted to validate these predictive models for waste streams.

A program to support PMN review related to genetically engineered organisms will be conducted through technology and engineering assessments of the potential for environmental contamination, and physical, chemical and biological techniques and devices to contain and destroy these organisms. Engineering safety and quality control programs will be emphasized.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
WERL/CIN	Clyde Dempsey	531.5	18
OEET/HQ	Don Tang	0	0

Toxic Chemical Testing/Assessment

Biotechnology/Microbial and Biochemical Pest Control Agents

Environmental Processes and Effects

The biotechnology research effort is concerned with interactions between microorganisms and ecological processes in an attempt to develop comprehensive knowledge of the biochemical, physiological, and genetic mechanisms involved. The program will examine the potential environmental risk associated with the application of genetically engineered microorganisms (GEMs).

Assessment of environmental impacts of GEMs requires reliable methodologies for identification enumeration in environmental samples. The methods must address the analytical and operative criteria required for any monitoring program. They must be sensitive and specific to differentiate GEMs from the background of indigenous organisms. They have to be feasible, accurate, reproducible, and widely applicable since samples will differ greatly from one another, such as leaf surfaces and freshwater reservoirs.

In addition, laboratory systems (microcosms) containing sediment, water, and indigenous microorganisms are used to assess the fate of GEMs in various ecosystems. These systems attempt to simulate interactions between microorganisms surfaces. The fate of microbes in microcosms is compared with fate in natural systems to assess the validity of laboratory data.

Research in this area applies techniques of molecular and classical genetics to ecological studies to address questions on survival and growth of novel microorganisms. Questions such as specific niche requirements, selective advantages of new genotypes, and potential for causing harmful effects to populations, ecosystems, or processes will be examined. The work requires techniques to enumerate and detect GEMs or genetic material in complex ecosystems. The research also addresses genetic stability of altered microorganisms, including transmissibility of plasmids and other genetic information *in situ*.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/GB	Henry F. Enos	1,948.4	11.7
ERL/COR	T. Murphy	1,947.4	11.7

Biotechnology/Microbial and Biochemical Pest Control Agents

Health Effects

Biotechnology research is aimed at the development of methods to evaluate the potential health hazards of

genetically engineered organisms and the products of these microorganisms. Potential mechanisms of action and screening methods for adverse mechanisms are being investigated. Models are being developed to assess the potential dispersal capability of genetically engineered genes.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP OHR/HQ	William F. Durham Lynda Erinoff	337.8	45

Ecology: Ecotoxicity and Risk Assessment

Environmental Processes and Effects

Environmental risk assessment studies on the linkage of environmental exposure and ecotoxicology hazard assessment techniques, and development of methods to evaluate risks associated with genetically engineered organisms have been initiated.

The ecotoxicology study includes the movement, transformation and ultimate disposition of toxic substances in all environmental media and is a critical component of this risk assessment. How plants and animals or larger ecosystems are affected by toxic substances are also the subjects of this research effort. This involves specific activities for developing and validating tests and methodologies for assessments on specific existing chemical evaluations to be used in rule making by the Office of Toxic Substances.

Activities in this research program are conducted at four field laboratories and EPA headquarters as follows:

- ERL/Athens—transport and transformation of organic and inorganic substances in freshwater and multi-media environments, and development of SAR techniques and models to predict the fate of new chemicals;
- ERL/Corvallis—fate and effects of toxic substances and genetically engineered organisms in terrestrial environments;
- ERL/Duluth—effects of toxic substances in freshwater environments, and development of SAR regarding the effects of new chemicals;
- ERL/Gulf Breeze—fate and effects of chemicals and genetically engineered organisms in estuarine/marine environments.

Toxic Chemical Testing/Assessment

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/ATH	Rosemarie C. Russo	405.6	100
ERL/COR	Thomas A. Murphy	56.7	100
ERL/DUL	Gilman Veith	0.0	0
ERL/GB	Henry F. Enos	0.0	0
OEPER/HQ	Frederick W. Kutz	1,631.8	0

Ecology: Transport/Fate/Field Validation

Environmental Processes and Effects

This research encompasses the determination of the effects, movement, transformation, and ultimate relocation of toxic substances and their degradation products that inadvertently enter into all environmental media. This program provides information on how plants and animals and larger ecosystems are affected by exposure to toxic substances caused by accidents in commerce and industry. Specific activities include developing and validating tests for assessing hazards, exposure and estimation of the fate of existing chemicals.

Information developed in the above studies provides data necessary for hazard and exposure assessment tests and mathematical models of chemical transport, transformation and fate. These results allow the Agency to determine toxic substances in environmental media and to relate these estimates to terrestrial and aquatic systems. These data are used as input to models which predict the accumulation of toxic chemicals in food chains. This research will demonstrate how important biodegradation is in this process.

Activities in the programmatic areas of transport, transformation and fate, and biodegradation of chemicals are conducted at four field laboratories. Their locations and the research they conduct are as follows:

- ERL/DUL—effects of toxic substances in freshwater environments;
- ERL/GB—fate and effects of toxic chemicals and genetically altered organisms in estuarine/marine systems;
- ERL-NARR—chemical fate and effects in marine systems;
- ERL/COR—fate and effects of toxic substances in terrestrial systems.

Toxic Chemical Testing/Assessment

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/ATH	Rosemarie A. Russo	760.5	100
ERL/GB	Henry F. Enos	826.8	91.6
ERL/COR	Thomas A. Murphy	488.0	100
ERL/DUL	Gilman Veith	153.0	100

Exposure Monitoring

Acid Deposition Environmental Monitoring and Quality Assurance

Research for exposure monitoring is dedicated to development and improvement of methods to estimate total human exposure and population exposure. Geostatistics, human activity pattern analysis, model evaluation and application of geographic information systems are used to improve population estimates of exposure. Personal exposure monitoring, including total human exposure methodology, is compared to network monitoring systems to improve techniques to estimate an individual's pollutant exposure in all media.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	Shelly Williamson	1,818.8	30
EMSL/RTP	John Puzak	903.9	12
ADEMQA/HQ	Michael Dellarco	0.0	0

Health: Markers, Dosimetry, and Extrapolation,

Health Effects

This research is aimed at providing techniques to reduce the uncertainties in risk assessments. Techniques are needed to extrapolate between adverse effects seen in animal species and human health effects and between high doses used in animal toxicity testing and low doses typical of environmental exposure. Dosimetry models are being developed for dermal and inhalation routes of exposure. Biological markers research focuses on the development of indicators of biological dose and resulting effects for eventual application to studies of human populations.

Office or Laboratory	Contact	Total Funds ($k)	Percen In-Ho
HERL/RTP	William F. Durham	6,228.9	2
OHR/HQ	Lynda Erinoff		

Toxic Chemical Testing/Assessment

Special Human Data Needs

Health Effects

This research is designed to provide information to assist in identifying and regulating existing chemicals with potential human health risks. Research focuses on developing epidemiological and biostatistical methods. Efforts in biochemical epidemiology are underway to identify and evaluate biomonitoring and screening methods for potential application to human environmental epidemiology.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	William F. Durham	2,532.2	13
OHR/HQ	Lynda Erinoff		

Structure Activity Relationships

Environmental Processes and Effects

This thematic research program is designed to determine the disposition of new toxic chemicals in all environmental media and how to determine if selected plants and animals might be affected. This involves developing structure-activity relationships (SAR) for rapid estimation of the fate and effects of new chemicals. Structure-activity relationship research develops methodologies based upon molecular structure characteristics to rapidly assess the environmental fate and toxicity of new chemicals. Structure-activity includes those data bases mathematical models which are used for predicting bioaccumulation, toxicity, and fate. Activities also include the development of data bases on plant uptake, fate of organic chemicals, toxicity to fish and reactivity of chemicals in the air. Activities in this research program area are conducted at two field laboratories. Their geographic locations and the kinds of research they conduct are as follows:

- ERL/ATH—transport and transformation of both organic and inorganic substances in freshwater and multi-media environments and development of SAR to predict the potential fate of new chemicals.
- ERL/DUL—effects of toxic substances in freshwater environments, and development of SAR to predict the effects of new chemicals on aquatic organisms.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/ATH	Rosemarie C. Russo	354.9	100
ERL/DUL	Gilman Veith	362.9	66

Toxic Chemical Testing/Assessment

Health Effects

Structure Activity Relationships

Methods are being developed to use combinations of descriptions based on molecular structure to predict enzymatic, genetic, carcinogenic, and other activities of new chemicals to support section 5 of TSCA. Techniques include pattern recognition and statistical and thermodynamic analyses. In addition, chemical data bases are being constructed for use in predicting toxicological responses for new chemicals with similar structures.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	William F. Durham	1,216.9	36
OHR/HQ	Lynda Erinoff		

Acid Deposition Environmental Monitoring and Quality Assurance

Support for Toxic Substances Control Act (TSCA)

Quality assurance efforts are dedicated to providing support program activities. Specifically, research is conducted to evaluate the reliability and reproducibility of analytical methods for complex organic chemical compounds used in monitoring networks, to produce reference chemicals and analytical spectra and to provide quality assurance for program office sample collection in field studies.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	Tom Clark	186.5	13
EMSL/LV	Shelly Williamson	1,174.3	31
EMSL/RTP	John Puzak	318.8	7
ADEMQA/HQ	Michael Dellarco	26.8	0

Scientific Assessment

Support for Toxic Substances Control Act (TSCA)

The scientific assessment program provides evaluations and assistance to the Office of Toxic Substances in the conduct of uniform risk assessment procedures for carcinogenicity, mutagenicity, adverse reproductive developmental effects, and exposure.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OHEA HQ	Lawrence Valcovic	115	88

Toxic Chemical Testing/Assessment

Engineering

Environmental Engineering and Technology

The areas of focus in this research program are the identification and evaluation of alternatives to mitigate release and exposure of chemicals which will be used by the Agency in regulating the manufacture and use of existing chemicals and the development of predictive capabilities to be used in assessing release and exposure in the review of Premanufacturing Notices (PMN's) for new chemicals as required by TSCA.

Alternatives to mitigate release and exposure of specific existing chemicals will be defined in cooperation with industry, through the evaluation and adaptation of control measures related to the release in the workplace and into the environment of the chemicals during their life cycles. Technologies, management practices, and personal protective equipment to limit the release and exposure of chemicals will be evaluated.

Models to predict the release and exposure of different classes of new chemicals will be developed in cooperation with industry. The models will address different chemical unit operations, unit processes and physical/chemical properties of chemicals and predict potential exposure and release levels as well as best control measures to mitigate release and exposure of new chemicals. Pilot scale testing for the treatability of classes of potentially toxic chemicals will be conducted to validate these predictive models for waste streams.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
WERL/CI	Clyde Dempsey	2,393.1	19
OEET/HQ	Don Tang	123.4	69

Test Method Development

Acid Deposition Environmental Monitoring and Quality Assurance

Test methods development research seeks to provide improved procedures to identify and quantitate chemical compounds of interest. Emphasis is placed on development of biological and chemical procedures to estimate total human exposure from different media and to measure pollutant dose in the body. New statistical techniques are developed for field study designs and population sampling to improve network monitoring systems and population exposure assessments.

Toxic Chemical Testing/Assessment

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	Tom Clark	153.3	20
EMSL/LV	Shelly Williamson	544.7	23
EMSL/RTP	John Puzak	437.8	27
ADEMQA/HQ	Michael Dellarco	0.0	0

Test Method Development

Environmental Processes and Effects

Environmental hazard assessment research focuses on developing, improving and validating single and multi-species toxicity tests for chronic and acute toxicity in aquatic and terrestrial ecosystems. The developed methods are validated in microcosms in the laboratory, and in natural and constructed field ecosystems to define their applicability in real-world situations.

Test methods development for aquatic and terrestrial biota provides new or modified bioassays for plants and animals and is an essential part of hazard assessment. This effort encompasses the cellular level of organisms and includes larger ecosystems to assess how exposure to toxic substances can adversely affect these biological systems. These methods are verified and validated both in the laboratory and in the field using specific chemicals before they are given to the Office of Toxic Substances for the assessment of existing chemicals.

Activities in this program are carried out in four field laboratories. Their locations and kinds of research conducted are as follows:

- ERL/Duluth—effects of toxic substances in freshwater environments;
- ERL/Gulf Breeze—fate and effects of toxic chemicals and genetically altered organisms in estuarine/marine systems;
- ERL/Narragansett—chemical fate and effects in marine systems; and
- ERL/Corvallis—fate and effects of toxic substances and in marine systems.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/DUL	Gilman Veith	143.1	100
ERL/GB	Henry F. Enos	268.0	100
ERL/NARR	Norbert A. Jaworski	126.3	100
ERL/COR	Thomas A. Murphy	369.9	100

Toxic Chemical Testing/Assessment

Health Effects

Test Method Development

Under the Toxic Substances Control Act, EPA must provide industry with guidance to test chemicals for potential hazards to public health. In order to base regulatory decisions on the best possible data, reliable test methods must be developed for incorporation into test guidelines. The goal of this research is to develop short-term, cost-effective, predictive methods for detecting the toxic effects of chemicals. These test systems include both *in vitro* and *in vivo* methods and bioassays for predicting adverse health effects such as alterations in reproductive and developmental processes, and immunotoxic and neurotoxic effects.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	William F. Durham	1,675.6	57
OHR/HQ	Lynda Erinoff		

Scientific Assessment

Test Method Development

The role of the scientific assessment program is to reduce the uncertainties associated with risk assessment by conducting or sponsoring efforts intended to develop and/or improve approaches and methods in this area. Efforts include the development of biologically-based models to extrapolate laboratory-derived data to human risk applications, assessment of risk as a function of different exposure scenarios and the quantification of exposure that incorporates pharmacokinetic/pharmacodynamic factors, and the development of methods that can be directly applied to human populations to assess the occurrence and degree of exposure and estimate the probable health risk.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OHEA/HQ	Lawrence Valcovic	304	34

Pesticides

Biotechnology/Microbial and Biochemical Pest Control Agents

Environmental Processes and Effects

This portion of the research program is planned to develop or improve bioassay methodologies for determining the effects of biological control agents or biochemical agents (e.g. hormones, pheromones) on non-target biotic receptors. The application of the results assists in establishing testing guidelines and in registering and controlling the use of these control agents. Agents of interest include both genetically altered and unaltered bacteria, viruses and fungi. Parameters to be studied include routes of exposure, methods to recover or identify the agents and virulence, toxicity and infectivity. Survival, monitoring, growth, persistence and effects plus controlling abiotic factors are of concern. Probable genetic transfer/stability and the risks associated with genetically engineered microorganisms (GEMs) will be investigated. Special handling and testing methods and systems will be studied.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/COR	Thomas A. Murphy	505.5	21
ERL/DUL	Gilman Veith	246.2	39
ERL/GB	Henry Enos	842.1	48

Biotechnology/Microbial and Biochemical Pest Control Agents

Health Effects

Models will be developed on potential interaction of microbial agents and the mammalian cell. Goals are (1) the determination of the ability of microbial agents to replicate, and (2) to provoke immune responses in non-target (mammalian) hosts. Methods will also be developed using monoclonal antibodies and biotinated DNA probes to enable the identification of genetic material from microbial pesticides in non-target sites such as mammalian cells *in vitro* and *in vivo*.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	William F. Durham	868.0	15
OHR/HQ	Charles T. Mitchell		

Pesticides

Ecology: Ecotoxicity and Risk Assessment

Environmental Processes and Effects

To register or re-register pesticides it is necessary to develop a focused risk assessment process for integrating hazard and exposure assessments into models which express the probability of risk to important non-human populations. This facet of the research program develops environmental risk assessment methodology by combining impact data using existing or new models to express risk as a probability with estimates of the associated uncertainty.

New endpoint responses will be studied encompassing ecosystem structures and function. Selected wildlife and microbial populations will be used to reflect population changes and other changes that influence risk evaluations. Other parameters that affect model integrity will be studied (e.g., species susceptibility; chemical routes of exposure and uptake and residues). Modeling will be supported through data integration and the model, its calibration and validation will be supported through field studies which includes all media. Upon completion of the planning cycle all extramural monies will be disbursed through the participating laboratories.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/ATH	Rosemarie C. Russo	0.0	0.0
ERL/COR	Thomas A. Murphy	52.7	100
ERL/DUL	Gilman Veith	0.0	0.0
ERL/GB	Henry Enos	0.0	0.0
OEPER/HQ	Frederick Kutz	789.6	0.0

Ecology: Transport/Fate/Field Validation

Environmental Processes and Effects

Research will concentrate on the development, refinement and validation of techniques and models to measure and predict pesticide transport, degradation, exposure, effects and fate in the environment. Laboratory and field studies will be conducted to substantiate the applicability of methods and mathematical models and to insure that results are valid and reflect environmental responses under natural conditions. Data from these studies will be used to assess pesticide hazards to surrogate species, populations and communities representative of aquatic and terrestrial habitats.

These investigations will include analysis of abiotic influences on study results and on various chemical and physical factors and processes. Sorption, leaching and residues will be evaluated. Ground water contamination and

associated processes will be explored and remedial actions sought. Predictive techniques for exposure concentrations will be improved with studies on pesticide sorption kinetics, transformations and mechanisms of degradation.

Information and data including assessments and predictive tools, evaluations of assessment criteria, reference hand books and manuals, workshops and reviews are transferred to support the Agency's regulatory actions.

Laboratories involved in this research are shown below. Most extramural monies currently retained at Headquarters will be dispersed to the laboratories subsequent to final planning actions.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/ATH	Rosemarie C. Russo	353.3	100
ERL/COR	Thomas A. Murphy	393.2	42
ERL/DUL	Gilman Veith	399.2	42
ERL/GB	Henry Enos	825.7	73
OEPER/HQ	Frederick Kutz	1,164.4	28

Engineering

Environmental Engineering and Technology

This research program supports the Office of Pesticides Regulatory Program in making determinations as to whether or not certain types of protective clothing reduce exposure to pesticides during application. Laboratory studies will be initiated on the permeability and penetrability by highly toxic pesticide compounds for various fabric and rubber compounds used for protective clothing. This work will establish effects of wearing apparel degradation and decontamination (e.g., laundering) on pesticide retention and on continued protective capability of the fabrics.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
WERL/CIN	Alden Christianson	903.2	6
OEET/HQ	Don Tang	0	0

Exposure Monitoring

Acid Deposition Environmental Monitoring and Quality Assurance

The Non-Occupational Pesticide Exposure Study (NOPES) is being conducted to develop and test Total Exposure Assessment Methodology (TEAM) approach for measurement of pesticides used routinely by the general population. This study will evaluate TEAM methods for pesticide exposure and determine if non-occupational pesticide usage in and about homes should be studied further as an important pollutant source.

Pesticides

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL RTP	Gerald Akland	394.1	0
ADEMQA/HQ	Michael Dellarco	0	0

Health: Markers, Dosimetry and Extrapolation

Health Effects

Models will be developed using animals as test species. This research will include evaluation of interspecies differences in the dermal absorption of pesticides, examination of structure-activity relationships in teratogenesis, examination of metabolic differences between species which may contribute to teratogenic outcomes, and the investigation of potential interactions between alterations in maternal health status and susceptibility teratogenic exposures. Additionally, a computerized data management system which analyzes genetic data will continue to be developed.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	William F. Durham	1,241.0	44
OHR/HQ	Charles T. Mitchell		

Support for the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

Acid Deposition Environmental Monitoring and Quality Assurance

The pesticides quality assurance program ensures the accuracy of the data which is attained through testing and analysis. This program maintains a pesticide repository of high purity chemicals which are used by more than 1,400 laboratories in the United States and in foreign countries. These samples are used as standard reference samples for internal quality control. In addition, interlaboratory comparison samples are prepared. Also, the program will provide samples of pesticide chemicals no longer produced, but still regulated, in the United States. Such reference samples are necessary to perform analyses in soil, plant, or animal tissues at the required degree of accuracy.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	R. K. Mitchum	1,103.7	37
ADEMQA/HQ	Jim Shackelford	0.0	0

Pesticides

Support for the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

Scientific Assessment

In support of EPA's role in regulating pesticides, EPA's researchers prepare and review risk assessment documents for carcinogenicity, mutagenicity, adverse reproductive effects and exposure for pesticide compounds as requested by the Office of Pesticide Programs.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OHEA/HQ	Lawrence Valcovic	262	100.0

Test Method Development

Environmental Processes and Effects

Laboratory studies will develop and validate bioassay methodologies to be used as standardized pesticide testing protocols for marine/estuarine and freshwater organisms. Various methods will be geared to testing chosen life stages of representatives or surrogate test species for long-term or short-term durations. These methods will assess both exposure and effects of pesticides under acute and chronic conditions and some may be used for monitoring particular pesticides or sensitive biota and for predicting response. Influencing environmental factors which may modify testing results will be studied to establish confidence limits for the methods under given conditions. The methods will contribute to establishing or modifying pesticides testing guidelines.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/GB	Henry F. Enos	308.3	100
ERL/DUL	Gilman Veith	67.9	100

Test Method Development

Health Effects

This research involves developing and refining bioassays for the detection of adverse alterations in the development and reproductive processes of animals which allow for more accurate evaluations of reproductive development and function. Techniques are also being developed, validated, refined and implemented for determining genetic effects caused by human exposure to chemical carcinogens and mutagens. Additionally, methods are being developed to

refine the relationship between biological indicators of neurotoxicity and disease as well as methods development in the area of immunotoxicology.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP OHR/HQ	William F. Durham Charles T. Mitchell	1,851.4	70

Test Method Development

Scientific Assessment

The scientific assessment program carries out specific risk assessment work in direct support of the Office of Pesticide Programs, prepares and reviews guidelines for Agency-wide application in conducting risk assessments, and seeks to reduce the uncertainties in risk assessment through development of new risk assessment techniques and methods. Assessment methods are being reviewed and updated to address program-specific problems, including data gathering and analysis of heritable risks from low-dose exposures. Research is also underway to evaluate human reproductive dysfunction, which may result from exposure to chemicals.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OHEA/HQ	Lawrence Valcovic	509	27

Multi-Media Energy

Develop and Evaluate LIMB Technology

Environmental Engineering and Technology

This area is supporting the evaluation of alternative acid rain control technologies research: specifically the development for commercialization of an integrated NO_x/SO_2 control technology—The Limestone Injection Multistage Burner (LIMB).

The LIMB control technology can substantially reduce both NO_x and SO_2 emissions while at the same time reducing the costs for control. A systematic development is underway to bring the LIMB technology to the point where industry would be willing to commercialize it. The 1987 program will include: research on sorbent reaction mechanisms, prototype scale testing of the tangentially-fired experimental systems for extrapolating the performance to commercial scale, detailed analysis to identify potential operability and reliability problems, and installation and initial operation of the industry/EPA cofunded full scale demonstration on wall-fired utility boiler.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	Jim Abbott	3,770.4	28
OEET/HQ	Marshall Dick	251.8	82

Establish Deposition Monitoring Data Base

Acid Deposition Environmental Monitoring and Quality Assurance

Efforts will involve development of real-time precipitation measurement methods, as well as the development of field techniques for measuring dry deposition. Quality assurance, data systems support, and analysis of spatial and temporal variation of data are an integral part of the program. The first 45 sites of the dry deposition monitoring network will be in place.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/RTP	Steven Bromberg	6,181.5	6
ADEMQA/HQ	Richard A. Livingston		

Multi-Media Energy

Acid Deposition Environmental Monitoring and Quality Assurance

Estimate Emissions from Man-Made Sources

This research effort gives primary emphasis to the development of a high quality emissions data base for calendar year 1985. SO_2, NO_x, and VOCs are the emission species of principal interest. Models to forecast emission trends and costs of various control programs are being developed. These economic sectoral models and the emissions inventories will be used to support regional and national policy analysis and assessment.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	Michael Maxwell	3,379.5	35
ADEMQA/HQ	Lowell Smith		

Acid Deposition Environmental Monitoring and Quality Assurance

Evaluate Availability and Cost of Applicable Control Technology

This program assesses the engineering and economic potential of emerging technologies for removing acid deposition precursors from combustion sources. The work considers non-hardware approaches such as fuel switching as well as retrofit technologies such as the limestone injection multi-stage burner, E-SO_x and duct injection.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	Julian Jones	623.0	35
ADEMQA/HQ	Lowell Smith		

Acid Deposition Environmental Monitoring and Quality Assurance

Understand and Quantify Effects on Material and Cultural Resources

Both chamber and field studies will continue on selected metals and paint/substrate systems. A damage function for galvanized steel will be completed. A study of pollutant transport through concrete and a pilot study on intra-city variability of pollutants will be initiated. A non-residential materials inventory data base will be compiled and the materials inventory model refined.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ASRL/RTP	John Spence	2,700.0	3
ADEMQA/HQ	Richard A. Livingston		

Multi-Media Energy

Understand and Quantify Aquatic Effects

Acid Deposition Environmental Monitoring and Quality Assurance

Using the sampling frame of the Eastern and Western Lake Surveys and the Stream Survey in the Southeast (all completed in 1986), research into the extent, duration, and frequency of variations in surface water chemistry will continue in 1987 (National Surface Water Survey, Phase II; Episodic Response Project). Analysis of soils data in watersheds of the Northeast and Southeast will continue, leading to predictions of the future rate of change of surface water chemistry, based on single-factor analyses (i.e., cation exchange, sulfate adsorption) and dynamic modeling (Direct/Delayed Response Project). Assumptions and hypotheses upon which the predictions depend will be tested and evaluated via experimentally acidified watersheds (Watershed Manipulation Project).

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/COR	Robert A. Lackey	5,579.3	9
EMSL/LV	Robert Schonbrod	4,162.0	5
EMSL/RTP	Rick A. Linthurst	320.0	35
ADEMQA/HQ	John L. Malanchuk	8,425.9	7
ASRL/RTP	Jack L. Durham	75.0	31
ERL/DUL	John G. Eaton	390.0	5

Understand and Quantify Terrestrial Effects

Acid Deposition Environmental Monitoring and Quality Assurance

Research will be performed at several integrated, multi-disciplinary intensive research sites in spruce/fir, southern commercial, eastern hardwood, and western coniferous forest types. The effects of acidic deposition alone or in combination with associated pollutants will be considered in the light of hypothesized mechanisms. A vegetation survey and a central synthesis and integration activity will be undertaken in support of this research.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/RTP	Ron Bradow	1,134.3	3.0
ASRL/RTP	Jack Durham	1,900.8	7.5
ERL/COR	Robert A. Lackey	6,868.1	2.7
ADEMQA/HQ	Anthony Janetos	1,650.8	20.1

Multi-Media Energy

Understand Atmospheric Processes

Acid Deposition Environmental Monitoring and Quality Assurance

This research is designed to improve our capability to examine and predict the atmospheric transport, chemical transformation and the wet and dry deposition of acidic substances emitted into the atmosphere. Laboratory and field studies, using chemical tracers of emissions, recently developed gas measuring instruments, and extensive monitoring is being undertaken to study the movement and transformation of acids and their precursors from sources to receptors. Modules which mathematically simulate the atmospheric processes are being developed for the Regional Acid Deposition Model (RADM). A major field program has been proposed to test and evaluate RADM.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ASRL/RTP	Jack Durham	10,281.6	6
ADEMQA/HQ	Dennis Trout		

Intermedia

Manage the Mandatory Quality Assurance Program

Acid Deposition Environmental Monitoring and Quality Assurance

A significant portion of EPA's budget is spent on collecting environmental data. Quality assurance (QA) activities play an integral role in the planning and implementation of environmental data collection efforts and in evaluation of the resulting data. By means of their QA programs, EPA organizations can enjoy substantial resource savings, because they collect only those data that are needed, and because they can be sure that the data they collect are of the requisite quality.

Quality assurance is the process of *management* review and oversight at the planning, implementation, and completion stages of an environmental data collection activity to assure that data provided by a line operation to data users are of the quality needed *and* claimed. Quality assurance should not be confused with quality control (QC); QC includes those activities required *during* data collection to produce the data quality desired and to document the quality of the collected data (e.g., sample spikes and blanks).

Quality assurance programs consist of specific activities conducted before, during and after environmental data collection. During the planning of an environmental data collection program, QA activities focus on assuring that the quality of the data needed by data users has been defined, and that a QC system has been designed for measuring the quality of the data being collected. During the implementation of a data collection effort, QA activities ensure that the QC system is operating and that problems found by QC are corrected. After environmental data are collected, QA activities focus on assessing the quality of the data obtained. Here, one determines whether the data obtained are adequate to support data-dependent regulatory decisions or research hypotheses.

The Quality Assurance Management Staff (QAMS) is charged with overseeing the quality assurance activities of the Agency. QAMS came into being in May 1979, when the Agency recognized the need for formalizing an Agency-wide quality assurance program for all environmental data collection activities. More recently, with the issuance of EPA Order 5360.1 in April 1984, the Agency's quality assurance program has been significantly strengthened and broadened. The Order mandates that QA be an integral part of all environmental data collection activities, from planning through implementation and review.

The Order identifies the activities basic to the implementation of a QA program. These include:

- requiring QA in all Agency-supported environmental data collection activities,
- defining Data Quality Objectives,
- developing quality assurance program and project plans,
- conducting audits,
- implementing corrective actions based on the audits,
- establishing achievable data quality limits for methods cited in EPA regulations,
- developing and adopting technical guidelines for assessing data quality, and
- providing for QA training.

In recent years, the Agency's QA activities have focused on identifying the basic elements that are essential to effective quality assurance for environmental data. QAMS has put considerable emphasis on issuing guidance defining these key elements and describing their importance in the efficient and effective expenditure of resources assigned to environmental data collection. For FY 1987, the emphasis of the QA program is to make a transition from the guidance phase to full-scale program implementation and oversight.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ADEMQA/HQ	Stanley Blacker	1,201.5	67

Manage Visiting Scientists Program

Exploratory Research Core Program

The Visiting Scientists Program has two components: a summer fellows program and a distinguished visiting scientists program. The summer fellows program is carried out in conjunction with the American Association for the Advancement of Sciences and sponsors environmental science and engineering fellows for the summer months. In FY 1986 10 highly qualified fellows were sponsored to conduct research at EPA. The distinguished visiting scientists program attracts distinguished senior scientists into the Agency for 1 to 3 years to assist in strengthening the Agency's science policy and research program. in FY 1986, five new visiting scientists were sponsored to conduct research in ORD laboratories.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OER/HQ	Roger Cortesi	900	0

Intermedia

Manage Exploratory Research Grant and Centers Program

Exploratory Research Core Program

The Research Grants Program supports research initiated by individual investigators in areas of priority interest to the Agency which are published annually in a "Solicitation for Research Grant Proposals" and published in special solicitations called the "Request for Applications (RFA)." For FY 1987, proposals are solicited in the areas of (1) environmental biology, (2) environmental health, (3) environmental engineering, and (4) environmental chemistry, physics and measurements. Priority research areas for FY 1987 include human health risk assessment, ecological risk assessment, total exposure and risk reduction. The Research Centers Program supports multidisciplinary research which is conducted in a university setting and focuses in areas of priority interest to EPA. For FY 1987, the following eight university research centers are sponsored:

Waste Elimination Research Center (Illinois Institute of Technology): study innovative technology and process modification to reduce industrial pollutants.

Intermedia Transport Research Center (University of California): define chemical/physical processes governing pollutant exchange at air-land and air-water boundaries.

Ecosystems Research Center (Cornell University): identify and apply ecosystem principles to environmental management problems.

Marine Sciences Research Center (University of Rhode Island): assess marine ecosystems health, emphasizing exposure of marine organisms to toxics.

Advanced Control Technology Research Center (University of Illinois): study separation technology, thermal destruction, biological separation, and chemical detoxification.

Ground Water Research Center (University of Oklahoma, Oklahoma State University, and Rice University): study subsurface characterization, transport and fate, and ground-water horizon modeling.

Epidemiology Research Center (University of Pittsburgh): study basic epidemiology methods and airborne particulate health effects.

Hazardous Waste Research Center (Louisiana State University): study the design, construction, maintenance, operation, and closure of hazardous waste landfills.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OER/HQ	Roger Cortesi	15,042	4

Intermedia

Integrated Risk Assessment

Scientific Assessment

The scientific assessment program provides uniform Agency-wide guidance on, and assures the consistency of, exposure and risk assessments that support regulatory decision making by EPA.

Final risk assessment guidelines were published in September 1986 on carcinogenicity, mutagenicity, developmental toxicity, complex mixtures, and exposure assessment. Additional guidelines on both male and female reproductive effects, systemic toxicity and pharmacokinetics are under development or in planning. A new Agency-wide Risk Assessment Forum provides a mechanism for inter-office exchange on science issues in risk assessment, advises the Agency on precedent-setting cases and important environmental risk assessment issues, and recommends revisions or updates to the risk assessment guidelines, as appropriate.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OHEA/HQ	William Farland	1,823	56

Radiation

Off-Site Monitoring Program

Acid Deposition Environmental Monitoring and Quality Assurance

The overall goal of the research program is to provide the scientifically credible data necessary to assess public exposure to non-ionizing radiation and to man-made radioactive materials and to allow decisions to be made regarding control of that exposure.

In addition, this program provides quality assurance for the Agency's programs for monitoring radiation in the environment. These are supported by providing a common source of radionuclides standards and reference materials and through the conduct of laboratory intercomparison studies to assure data of known quality from analyses of environmental samples such as milk, water, air and food.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	Charles Costa	159.3	100
ADEMQA/HQ	Jim Shackelford	0.0	0

Scientific Support for Radon Program

Environmental Engineering and Technology

The engineering program for radiation primarily supports the Agency's Radon Action Program. It is directed at developing and testing cost-effective methods for reducing radon in homes. The results of these tests, along with analysis of the findings of others, are provided to the States, private sector organizations (such as builders and contractors), and to homeowners. The research will continue to extend the number of techniques, the housing substructure types and the locations for testing. The research focuses primarily on mitigation in existing homes, although techniques applicable to prevention in new house construction will also be assessed.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	Chick Craig	1,107.3	82
OEET/HQ	Paul Shapiro	84.7	96

ORD Organization

The Office of Research and Development is responsible for research, development, and demonstration programs in pollution sources, fate, and health and welfare effects; waste management and utilization technology; environmental sciences; and monitoring systems. Please note, the list below includes both commercial (CML) and Federal (FTS) telephone numbers. Where only one number is listed, it serves both purposes.

Assistant Administrator for Research and Development

Acting, Donald J. Ehreth
Headquarters, Washington, DC (RD-672) — (202) 382-7676

Deputy Assistant Administrator

Donald J. Ehreth — (202) 382-7676

Senior ORD Official, Cincinnati

Francis T. Mayo
Cincinnati, OH 45268 — (513) 569-7951
FTS 8-684-7951

Support Services Office
Director, Robert N. Carr — (513) 569-7966
FTS 8-684-7966

Senior ORD Official, Research Triangle Park

F. Gordon Hueter
Research Triangle Park, NC 27711 — CML (919) 541-2106
FTS 8-629-2106

Support Services Office
Director, Paul Kenline (MD-51) — CML (919) 541-2613
FTS 8-629-2613

Office of Research Program Management

Director, Clarence E. Mahan
Headquarters, Washington, DC (RD-674) — (202) 382-7500

Office of Exploratory Research

Director, Roger Cortesi
Headquarters, Washington, DC (RD-675) — (202) 382-5750

Research Grants Staff
Director, Clarice Gaylord — (202) 382-7473

Research Centers Program
Director, Robert A. Papetti — (202) 382-7473

Visiting Scientists Program
Coordinator, Robert A. Papetti — (202) 382-7473

Office of Health Research

Acting Director, Hugh McKinnon
Deputy Director, (Vacant)
Headquarters, Washington, DC (RD-683) — (202)382-5900

Program Operations Staff
Director, Tom Veirs (202) 382-5891

Water and Toxics Division
Acting Director, John R. Fowle (202) 382-5895

Air, Noise and Radiation Division
Acting Director, John R. Fowle (202) 382-5893

Health Effects Research Laboratory
Director, F. Gordon Hueter (MD-51) CML (919) 541-2281
Acting Deputy Director, Judith A. Graham FTS 8-629-2281
Research Triangle Park, NC 27711

Office of Acid Deposition, Environmental Monitoring, and Quality Assurance

Director, Courtney Riordan (202) 382-5767
Deputy Director, Matthew Bills
Headquarters, Washington, DC (RD-680)

Program Operations Staff
Director, Paul Palm (202) 382-5761

Quality Assurance Management Staff
Director, Stanley Blacker (202) 382-5763

Environmental Monitoring Systems Division
Director, Charles Brunot (202) 382-5776

Acid Deposition and Atmospheric Research Division
Director, Gary J. Foley (202) 475-8930

Environmental Monitoring Systems Laboratory
Director, Vacant (MD-75) CML (919) 541-2106
Deputy Director, John C. Puzak FTS 8-629-2106
Research Triangle Park, NC 27711

Environmental Monitoring and Support Laboratory
Director, Robert L. Booth (513) 569-7301
Deputy Director, Thomas A.Clark FTS 8-684-7301
Cincinnati, OH 45268

Environmental Monitoring Systems Laboratory
Director, Erich W. Bretthauer CML (702) 798-2525
Deputy Director, (Vacant) FTS 8-545-2525
P.O. Box 15027
Las Vegas, NV 89114

Vint Hill Station
Acting Director, Phillips A. Arberg CML (703) 347-6224
P.O. Box 1587, Building 166 FTS 8-557-3110
Warrenton, VA 22186

Atmospheric Sciences Research Laboratory
Director, Alfred H. Ellison CML (919) 541-2191
Deputy Director, Jack H. Shreffler FTS 8-629-2191
Research Triangle Park, NC 27711

Office of Health and Environmental Assessment

Director, Peter W. Preuss (202) 382-7317
Headquarters, Washington, DC (RD-689)

Program Operations Staff
Director, Barry Goldfarb (202) 382-7311

Cancer Assessment Group
Director, William Farland (202) 382-5898

Exposure Assessment Group
Director, Michael Callahan (202) 475-8909

Reproductive Effects Assessment Group
Acting Director, William Farland (202) 382-7303

Environmental Criteria and Assessment Office
Director, Lester Grant (MD-52) CML (919) 541-4173
Research Triangle Park, NC 27711 FTS 8-629-4173

Environmental Criteria and Assessment Office
Director, Jerry F. Stara (513) 569-7531
Cincinnati, OH 45268 FTS 8-684-7531

Office of Environmental Engineering and Technology

Director John H. Skinner (202) 382-2600
Headquarters, Washington, DC (RD-681)

Program Operations Staff
Director, Stephen Jackson (202) 382-2580

Technical Programs Division
Director, Darwin R. Wright (202) 382-5747

Air and Energy Engineering Research Laboratory
Director, Frank Princiotta (MD-60) CML (919) 541-2821
Deputy Director, Chick Craig FTS 8-629-2821
Research Triangle Park, NC 27711

Hazardous Waste Engineering Research Laboratory
Director, Thomas R. Hauser (513) 569-7418
Deputy Director, William Cawley FTS 8-684-7418
Cincinnati, OH 45268

Release Control Branch
Director, Ira Wilder CML (201) 321-6600
Edison, NJ 08817 FTS 8-340-6600

Water Engineering Research Laboratory
Director, Francis Mayo (513) 569-7951
Deputy Director, Lou Lefke FTS 8-684-7951
Cincinnati, OH 45268

Office of Environmental Processes and Effects Research

Director, James W. Falco (202) 382-5950
Deputy Director, (Vacant)
Headquarters, Washington, DC (RD-682)

Program Operations Staff
Director, Patricia M. Neuschatz (202) 382-5962

Water and Land Division
Director, Herbert B. Quinn (202) 382-5940

Toxics and Pesticides Division
Acting Director, Fredrick W. Kutz (202) 382-5967

Field Laboratories

Robert S. Kerr Environmental Research Laboratory
Director, Clinton W. Hall CML (405) 332-8800
Deputy Director, Marvin L. Wood FTS 8-743-2224
P.O. Box 1198
Ada, OK 74820

Environmental Research Laboratory
Director, Rosemarie C. Russo CML (404) 546-3134
College Station Road FTS 8-250-3134
Athens, GA 30613

Office of Research Operations CML (404) 546-3145
Director, Robert R. Swank FTS 8-250-3145

Office of Program Operations CML (404) 546-3127
Director, Roger K. NeeSmith FTS 8-250-3127

Environmental Research Laboratory
Director, Thomas A. Murphy CML (503) 757-4601
Deputy Director, James C. McCarty FTS 8-420-4601
200 SW 35th Street
Corvallis OR 97333

Environmental Research Laboratory
Acting Director, Gilman D. Veith CML (218) 727-6692
Acting Associate Director for Research, FTS 8-780-5548
Nelson A. Thomas
6201 Congdon Boulevard
Duluth, MN 55804

Monticello Field Station CML only
Box 500 (612) 295-5145
Monticello, MN 55362

Large Lakes Research Station CML (313) 675-5000
9311 Groh Road FTS 8-226-7811
Grosse Ile, MI 48138

Environmental Research Laboratory
Director, Norbert A. Jaworski CML (401) 789-1071
Deputy Director, Richard L. Garnas FTS 8-838-5087
South Ferry Road
Narragansett, RI 02882

Hatfield Marine Science Center CML only
Newport, OR 97365 (503) 867-4041

Environmental Research Laboratory
Director, Henry F. Enos
Deputy Director, Andrew J. McErlean
Sabine Island
Gulf Breeze, FL 32561

CML (904) 932-5333
FTS 8-686-9011

ORD Organizational Descriptions

Office of Exploratory Research

The Office of Exploratory Research supports a number of program activities related to the Agency's need to obtain high quality, reliable scientific information to address current and potential environmental problems. The program has several components: (1) the Research Centers Program, a university-based project, to support multidisciplinary research on defined environmental problems; (2) a Competitive Research Grants Program to foster and support investigator-initiated, peer reviewed research grants in priority program areas covering human health risk assessment, ecological risk assessment, total exposure and risk reduction; (3) the Distinguished Visiting Scientists Program (DVSP) to bring eminent scientists into ORD laboratories to broaden the scientific and technical base of EPA's research; (4) the Environmental Summer Fellows Program, to bring from the academic and private sector scientists, economists and engineers to EPA to work on important environmental issues during the summer months; (5) the Small Business Innovation Research (SBIR) Program to increase the opportunity for small high technology firms to help solve major environmental problems for EPA while contributing to the growth and development of small business; (6) the Minority Institution Assistance (MIA) Program to provide research grant and fellowship assistance to faculty and students from Historically Black Colleges and Universities; (7) the Agency's Senior Environmental Employment (SEE) Program to utilize the skills and talents of retired older Americans to meet the employment needs of environmental programs; and (8) the Federal Workforce Training program to coordinate ORD's participation in workforce training programs used by state and local governments.

Office of Environmental Engineering and Technology

The Office of Environmental Engineering and Technology is responsible for the assessment and the development of methods for control of the environmental and socio-economic impacts of municipal and industrial operations and of energy and mineral resource extraction, processing, conversion, and utilization systems.

The Hazardous Waste Engineering Research Laboratory in Cincinnati, Ohio, investigates ways to prevent, control, and treat hazardous wastes and Superfund related activities. This includes defining and characterizing sources of pollution, catalyzing advances in the state-of-the-art of pollution control, providing engineering concepts for cost-effective engineering solutions to difficult pollution problems and early-warning of emerging sources of pollution.

The Water Engineering Research Laboratory in Cincinnati, Ohio, investigates, develops and demonstrates cost-effective methods for the treatment and management of municipal wastewater and sludges and urban runoff; and of industrial processing and manufacturing and toxic discharges; and the development of technology and management systems for the treatment, distribution and presentation of public drinking water supplies.

The Air and Energy Engineering Research Laboratory in Research Triangle Park, North Carolina, catalyzes the development of control technologies and process modifications needed to establish and meet standards for air emissions in a timely and cost-effective manner, and supports EPA's regulatory and enforcement programs. The Laboratory also environmentally assesses the manufacture of synthetic fuels and other current and emerging energy sources.

Office of Health Research

The Office of Health Research is responsible for developing and evaluating toxicity test methods and for providing toxicity data to enable the agency to accurately identify hazards and determine human risk from environmental exposure. To fulfill this mission, research is conducted in three major areas:

- Toxicity test method development
- Generation of dose-response data
- Development of methods to use data from toxicity testing and dose-response studies to estimate human morbidity and mortality; including extrapolation from animal data to human effects, from high to low doses, and from acute toxicity to long-term effects.

The Health Effects Research Laboratory (HERL) with divisions in Research Triangle Park, North Carolina and Cincinnati, Ohio, conducts research, both intramurally and extramurally, which is responsive to these goals. Physical, biological and chemical agents are studied; and research is conducted in the scientific disciplines of inhalation toxicology, genetic toxicology, neurotoxicology, developmental and reproductive toxicology, microbiology, and epidemiology and biometry.

Office of Environmental Processes and Effects Research

The Office of Environmental Processes and Effects Research develops the scientific and technological methods and data necessary to understand, predict, and manage the entry, movement, and fate of pollutants in the environment and the food chain, and to determine the effects of pollutants upon nonhuman organisms and ecosystems.

The Robert S. Kerr Environmental Research Laboratory in Ada, Oklahoma, conducts research on the chemical, physical, and biological processes that affect contaminant transport and transformation in subsurface environments. The focus of the Laboratory's research is on both groundwater quality protection and utilization of the natural assimilative capacity of the subsurface as a waste disposal medium.

The Environmental Research Laboratory in Athens, Georgia, conducts fundamental and applied research required to predict and assess the human and environmental exposures and risks associated with conventional and toxic pollutants in water and soil ecosystems. This research is focused on the identification and characterization of the natural processes and environmental or chemical properties that affect the fate and effects of specific toxic substances, such as pesticides or metals, and on the development of state-of-the-art mathematical models for assessing and managing environmental pollution problems. The laboratory's Center for Water Quality Modeling distributes computer programs for selected models and provides training and assistance for users in government, industry, and academia.

The Environmental Research Laboratory in Corvallis, Oregon, conducts research on terrestrial and watershed ecology and assesses the comprehensive ecological impact of inland pollution and other environmental changes caused by man. This includes the ecological effects of airborne pollutants, such as acid deposition; the effects of toxic chemicals on terrestrial plants, animals, and ecosystems; the assessment and restoration of contaminated or degraded environments; the characterization and assessment of the vulnerability of ecological systems such as wetlands, to human impacts; and the ecological risks from the terrestrial release of bioengineered organisms and other biological control agents.

The Environmental Research Laboratory in Duluth, Minnesota, is responsible for developing national water quality criteria for the freshwater environment and has the primary research responsibility for describing the fate and effects of pollutants in the Great Lakes. Located on Lake Superior, the laboratory specializes in the toxicology of pesticides, industrial chemicals, and other pollutants in freshwater ecosystems. The Laboratory conducts major research in the water quality criteria program which develops the methodology for deriving numerical limits for industrial chemicals for the protection of aquatic life; the complex effluent program which seeks to develop cost-effective methods for managing the toxicity of wastewaters;

the structure-activity program which seeks to develop predictive technologies for estimating toxicity and fate of new chemicals; and the surrogate species program which is the EPA bridge between ecotoxicology and mammalian toxicology studies.

The Environmental Research Laboratory in Narragansett, Rhode Island, studies the impacts of point and indirect pollution on marine and estuarine ecosystems. Emphasis is on determining physical, chemical, and biological processes as they influence the fate, distribution, and effects of complex effluents and contaminated sediments or sludge. This research provides the scientific support for Agency decisions on regulating ocean outfalls and other point sources, nutrient management and near coastal and offshore disposal of wastes by dumping or incineration.

The Environmental Research Laboratory in Gulf Breeze, Florida, is responsible for the following research programs: (1) development of principles and applications of environmental toxicology, including toxic chemical exposure and effects on marine organisms and ecosystem processes; (2) development and evaluation of factors and mechanisms that affect biodegradation rates and bioaccumulation potential in food-webs; (3) development and verification of methods and data that allow extrapolation from laboratory observations to field situations, and from chemical structure to potential toxicity and biodegradation rates; (4) determination of effects of carcinogens, mutagens, and teratogens in aquatic species (individuals, populations); (5) development of aquatic species and test systems as indicators of environmental and human risk from exposure to chemicals; and (6) development of methods to evaluate environmental risk due to genetically altered microorganisms and other products of biotechnology.

Office of Acid Deposition Environmental Monitoring and Quality Assurance

The Office of Acid Deposition, Environmental Monitoring, and Quality Assurance is responsible for: (a) monitoring the cause and effects of acid deposition; (b) research and development on the causes, effects and corrective steps for the acid deposition phenomenon; (c) research with respect to the transport and fate of pollutants which are released into the atmosphere; (d) development and demonstration of techniques and methods to measure exposure and to relate ambient concentrations to exposure by critical receptors; (e) research, development and demonstration of new monitoring methods, systems, techniques, and equipment for detection, identification and characterization of pollutants at the source

and in the ambient environment and for use as reference or standard monitoring methods; (f) establishment, coordination, and review of agency-wide Quality Assurance Program; and (g) development and provision of quality assurance methods, techniques and material including validation and standardization of analytical methods, sampling techniques, quality control methods, standard reference materials, and techniques for data collection, evaluation and interpretation.

The Environmental Monitoring Systems Laboratory in Research Triangle Park, North Carolina, develops methods to measure and monitor pollutants in ambient air and emissions sources; operates the quality assurance program for measurement of air pollutants; develops techniques to assess population exposure to air pollutants including total human exposure models and field surveys; conducts research on indoor air pollution; and characterizes non-criteria pollutants in air, including air toxics.

The Environmental Monitoring Systems Laboratory in Las Vegas, Nevada, conducts research and development programs related to monitoring of pollutants in the environment; develops sampling strategies and techniques for monitoring hazardous waste leachates in soil and groundwater; develops remote sensing techniques; conducts human exposure monitoring and modeling studies covering several environmental media; evaluates analytical methods for the characterization and quantification of hazardous wastes; and provides quality assurance in support of the EPA's hazardous waste, "Superfund," pesticides and ionizing radiation programs.

The Environmental Monitoring and Support Laboratory in Cincinnati, Ohio, standardizes analytical test procedures to identify and measure major pollutants and microorganisms of health significance in drinking water, ambient receiving waters, and municipal and industrial effluents; operates the quality assurance program for the monitoring data on water pollutants; develops screening methods for use at hazardous waste sites; and provides technical support to water and waste monitoring programs.

The Atmospheric Sciences Research Laboratory in Research Triangle Park, North Carolina, conducts a research program in the physical sciences to detect, define, and quantify air pollution as it relates to urban, regional, and global atmospheres and acid deposition. It is responsible for the development of mathematical models in order to quantitate the relationships between emissions of pollutants from all types of sources, air quality, and atmospheric effects and the characterization of air pollution problems including, but not limited to, acid deposition.

Office of Health and Environmental Assessment

The Office of Health and Environmental Assessment (OHEA) is responsible for assessing the effects of environmental pollutants in varying exposure situations on human health and ecological systems and determining the degree of risks from these exposures. The risk assessments performed by OHEA are used by the Agency as the scientific basis for regulatory and enforcement decisions. OHEA's responsibilities also include the development of risk assessment guidelines and methodologies, and recommendations for new research efforts that will better support future EPA risk assessment activities.

Comprehensive methodologies are prepared for health assessments of both single chemicals and complex mixtures. Technical assistance to various agency programs and Regional Offices concerning acceptable pollutant levels and dose-response relations are also provided.

The Office includes five organizational groups:

The Environmental Criteria and Assessment Office in Research Triangle Park, North Carolina, is responsible for preparing air quality criteria documents and air pollutant health assessment documents for use in agency regulatory activities, as well as legislatively required health-related reports.

The *Environmental Criteria and Assessment Office* in Cincinnati, Ohio, prepares health and hazard assessment documents on water pollution and solid and hazardous wastes and hazardous air pollutants.

The *Carcinogen Assessment Group* evaluates the health risks associated with exposure to suspect carcinogens and prepares carcinogen assessments for use in the Agency's regulatory and enforcement decision-making processes.

The *Exposure Assessment Group* provides advice on the exposure characteristics and factors of agents that are suspected of causing detrimental health effects; provides state-of-the-art methodology, guidance, and procedures for exposure determinations; and prepares independent assessments of exposure and recommendations concerning the exposure potential of specific agents.

The *Reproductive Effects Assessment Group* prepares assessments on the risks associated with human exposure to suspect mutagens, teratogens, and agents that cause adverse reproductive effects; is involved in developing testing methods and basic research designed to improve the scientific basis for these assessments; and is active in coordinating research in these interrelated end points.

ORD Office/Laboratory Abbreviations

CERI/CIN Center for Environmental Research Information
Cincinnati, OH 45268
CML (513) 569-7391
FTS 8-684-7391

ECAO/CIN Environmental Criteria and Assessment Office
Cincinnati, OH 45268
CML (513) 569-7532
FTS 8-684-7532

ECAO/RTP Environmental Criteria and Assessment Office
Research Triangle Park, NC 27711
CML (919) 541-4173
FTS 8-629-4173

EMSL/CIN Environmental Monitoring and Support Laboratory
Cincinnati, OH 45268
CML (513) 569-7301
FTS 8-684-7301

EMSL/LV Environmental Monitoring Systems Laboratory
P.O. Box 15027
Las Vegas, NV 89114
CML (702) 798-2100
FTS 8-545-2100

EMSL/RTP Environmental Monitoring Systems Laboratory
Research Triangle Park, NC 27711
CML (919) 541-2106
FTS 8-629-2106

ASRL/RTP Atmospheric Sciences Research Laboratory
Research Triangle Park, NC 27711
CML (919) 541-2191
FTS 8-629-2191

ERL/ATH Environmental Research Laboratory
College Station Road
Athens, GA 30613
CML (404) 546-3154
FTS 8-250-3154

ERL/COR Environmental Research Laboratory
200 SW 35th Street
Corvallis, OR 97333
CML (503) 757-4601
FTS 8-420-4601

ERL/DUL Environmental Research Laboratory
6201 Congdon Boulevard
Duluth, MN 55804
CML (218) 727-6692
FTS 8-780-5548

ERL/GB Environmental Research Laboratory
Sabine Island
Gulf Breeze, FL 32561
CML (904) 932-5311
FTS 8-686-9011

ERL/NARR Environmental Research Laboratory
South Ferry Road
Narragansett, RI 02882
CML (401) 789-1071
FTS 8-838-5087

HERL/RTP Health Effects Research Laboratory
Research Triangle Park, NC 27711
CML (919) 541-2281
FTS 8-629-2281

HWERL/CIN Hazardous Waste Engineering Research Laboratory
Cincinnati, OH 45268
(513) 569-7418
FTS 8-684-7418

AEERL/RTP Air and Energy Engineering Research Laboratory
Research Triangle Park, NC 27711
CML (919) 541-2821
FTS 8-629-2821

WERL/CIN Water Engineering Research Laboratory
Cincinnati, OH 45268
CML (513) 569-7951
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OEPER/HQ Office of Environmental Processes and Effects Research
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OER/HQ Office of Exploratory Research
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Washington, DC 20460
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OHEA/HQ Office of Health and Environmental Assessment
(RD-689)
Washington, DC 20460
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